STANDARD SPECIFICATIONS
FOR
SEWERS AND DRAINS

NASHUA, NEW HAMPSHIRE
BOARD OF PU8LIC WORKS

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APPROVED AND ADOPTED
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DIVISION 1 - GENERAL

SECTION lA

APPLICABILITY & AUTHORITY

1. These specifications govern all sewerage and drainage construction within dedicated public ways and easements of subdivisions; and are issued under the authority given to the City Engineer and the Board of Public Works by-Chapter 16, Section 16-117; and by Chapter 18, Sections 18-21 thru 18-98 of the Nashua Revised Ordinances of 1987.

   If any conflict should arise between these specifications and Chapter 19, Article III, the more stringent shall govern.

2. These specifications also apply to that sewerage and drainage work which is constructed by Public Works Department employees, by virtue of its adoption as a standard by the Board of Public Works.

3. When so stated in the contract, these specifications shall govern the work of private contractors doing work under contract to the City of Nashua Board of Public Works.

4. These specifications shall govern the work of private contractors doing work within the city rights-of-way and/or easements.

5. These specifications shall govern the work of all private contractors doing work for developers, contractors, etc. in streets and easements which shall later be dedicated for acceptance by the City of Nashua.

6. All sewerage system project designs shall be in accordance with readopted New Hampshire Standard of Design (Env-Ws 700) published in July 1990.

7. All plans proposed for new sewerage systems, extensions and changes to existing systems must be submitted for review and approval by the State of New Hampshire Department of Environmental Services Water supply and Pollution Control Division.

8. These specifications shall govern all sewers constructed on private property, except for the house drains and building drains, which are covered by the plumbing code.

SECTION 1B

Definitions

"The Engineer" shall be understood to be the City Engineer, or his appointed representatives.

"The Contractor" shall be the party doing the construction: either a private contractor or the Department of Public Works crews as the case may be.

"Contract Drawings" shall be the construction drawings which have been approved by the City Engineer, signed "approved" and on file in his office.

"Sewer" - A pipe or conduit that carries waste water from residences, commercial buildings, industrial plants, and institutions, equivalent to "Sanitary Sewer."

"Drain" - A pipe or conduit that carries storm water and surface water, street wash, and other wash waters, but excludes domestic waste water and industrial wastes; equivalent to a "storm drain" or "storm sewer" and including "culverts."

"Inspector" shall be understood to be an inspector of the Department of Public Works.

SECTION 1C

QUALITY CONTROL

lC-1 AUTHORITY AND DUTIES OF INSPECTORS

Inspectors shall be authorized to inspect all work done and materials furnished. Such inspection may extend to all or any part of the work, and to the preparation or manufacture of the materials to be used. In case of any dispute arising between the Contractor and the Inspector as to materials furnished or the manner of performing the work, the Inspector shall have the authority to reject material or suspend the work until the question at issue can be referred to and decided by the Engineer. The inspector shall not be authorized to revoke, alter, enlarge, relax or -release any requirements of these specifications nor to approve or accept any portion of the work, nor to issue instructions, contrary to the Plans and Specifications.

The Inspector shall in no case act as a foreman or perform other duties or the Contractor or interfere with the management of the work by the Contractor. Any advice which the Inspector may give the Contractor shall in no circumstances be construed as binding to the Engineer in any way.

lC-2 INSPECTION OF THE WORK

The Contractor shall not lay or bury any pipes or casings or other appurtenances except in the presence of the Engineer or the Inspector. To this end, proper notice shall be given the Engineer by the Contractor of the time and place he intends to do the work. Any work which is done when the Engineer or Inspector is not present or which is done contrary to the direction of the Engineer shall be considered unauthorized and shall not be accepted. The Contractor shall remove and replace such work to the satisfaction of the Engineer when directed to do so. Such work satisfactorily replaced-will then be accepted.

SECTION 1D

SPECIAL CONTROLS

1D-l EROSION CONTROL

The Contractor shall take due precautions to minimize the run-off of pollution substances such as silt, clay, fuels, oils, bitumens, calcium chloride and any other polluting materials harmful to humans, fish or other life into the waters of the State.

1D-2 DUST CONTROL

Dust control shall be provided when deemed necessary by the Engineer so as to prevent damage and nuisance to adjacent property owners and public streets. The means of dust control may include the use of water, calcium chloride or other approved methods.

1D-3 TRAFFIC CONTROL

When, in the opinion of the Engineer, public safety or convenience requires the services of the police, the Engineer may direct the Contractor to request the Nashua Police Department to assign officers to direct traffic within the location of work.

Nothing contained herein shall be construed as relieving the Contractor of any of his responsibilities for protection of persons and property.

Police are to be paid by the Contractor.

DIVISION 2 - EARTHWORK

SECTION 2A

CLEARING AND GRUBBING

2A-1 SCOPE OF WORK

Clearing and grubbing shall be carried out where necessary. The Contractor will be allowed to remove only the trees and brush that are absolutely necessary for his construction operations. The Contractor shall be expected to save as many trees as is possible. The removal of all brush and trees, including their stumps necessary for construction purposes, shall be done in such a manner to present a neat appearance at the end of the work.

2A-2 CLEARING

Clearing shall consist of felling, cutting and the satisfactory disposal of trees, brush and other vegetation, down timber, and rubbish.

If land owners desire the timber or small trees, the Contractor shall cut and neatly pile it in 4-ft. lengths for removal by the land owner; otherwise the Contractor shall dispose of it by hauling away. No burning will be permitted unless the Contractor obtains the permission of the City of Nashua Fire Chief beforehand.

2A-3 GRUBBING

Grubbing shall be carried out where trees have been felled, and shall consist of the removal and disposal of stumps, including all roots larger than 3-in in diameter to a depth of 18-in. below ground surface and within 3 ft. radius of the trunk.

SECTION 2B

EARTH EXCAVATION AND BACKFILL

2B-1 SCOPE OF WORK

This section includes, except as elsewhere provided, trenching for pipe laying and appurtenances, including drainage, sheeting and bracing, backfilling, disposal of surplus material and restoration of trench surfaces in easements.

2B-2 SHEETING AND BRACING

The Contractor shall furnish, put in place, and maintain sheeting and bracing if required to support the sides of the excavation and prevent loss of ground which could damage or delay the work or endanger adjacent structures.

2B-3 DRAINAGE

The contractor shall furnish all materials and equipment and perform all incidental work required to install and maintain the drainage system he proposes for handling any ground water or surface water encountered. The contractor must alter his drainage methods if, in the opinion of the Engineer, the trench bottom is unsatisfactory.

2B-4 BACKFILLING

As soon as practicable after the pipe has been laid, jointed, properly bedded (and tested, if required) backfilling shall begin and thereafter be prosecuted expeditiously.

Sand which is free from stones and other foreign material shall be carefully placed to a depth of 1 ft. over the top of the pipe.

When the pipes are laid cross country, the remainder of the trench shall be filled with approved material.

Wherever a loam or gravel surface exists prior to cross-country excavations, it shall be removed, conserved, and replaced to the full original depth. In some areas, it may be necessary to remove excess material during the cleanup process, so that the ground may be restored to its original level and condition. If the Contractor prefers not to store loam or topsoil, he shall replace it with loam or topsoil of equal quality and in equal quantity.

When the pipes are laid in streets, the trench above the 1 ft. of selected material above the pipe shall be backfilled with suitable material in layers not to exceed 3 ft. and thoroughly compacted by mechanical equipment. The last 1 ft. shall be backfilled with compacted bank-run gravel unless an increase is directed by the Engineer.

Fragments of ledge and boulders not greater than 6 inches in diameter may be used ~n trench backfill providing that the quantity, in the opinion of the Engineer, is not excessive. Rock fragments shall not be placed until the pipe has at least 2 ft. of earth cover. Small stones and rocks shall be placed in thin layers alternating with earth to insure that all voids are completely filled. Large masses of filling shall not be dropped into the trench in a manner to endanger the pipe.

Bituminous paving shall not be placed in the backfill. Frozen material shall not be used under any circumstances.

All road surface shall be groomed immediately after backfilling. Dust control measures shall be employed at all times to the satisfaction of the Engineer.

SECTION 2C

EXCAVATION BELOW NORMAL GRADE AND GRAVEL REFILL

2C-1 SCOPE OF WORK

If, in the opinion of the Engineer, the material at or below the normal grade of the bottom of the trench (6" below grade of pipe bottom) is unsuitable for foundation, it shall be removed to the depth as directed by the Engineer and replaced by screened gravel or as specified below.

2C-2 EXCAVATION AND BACKFILLING

Excavation and backfilling below grade shall conform to all applicable provisions under Section 2B, including the requirements for sheeting and bracing and maintaining the trench.

2C-3 REFILL

Normally refill will be screened gravel, as specified under Section 2D; however, if the material at the level of trench bottom consists of fine sand, sand and silt, or soft earth which may work into the screened gravel notwithstanding effective drainage, the subgrade material shall be removed to the extent directed and the excavation refilled with coarse sand, or a mixture graded from coarse sand to fine pea stone, to form a filter layer preserving the voids in the gravel bed of the pipe. The composition and gradation of gravel shall be approved by the Engineer prior to placement. Gravel shall be placed in 6-in. layers thoroughly compacted.

SECTION 2D

GRAVEL FILL

Screened gravel shall be used for bedding pipe, as replacement material for ordered excavation below grade and as gravel cushion in ledge excavation. Bank run gravel may be used for the roadway gravel sub base under pavement, replacement of un-suitable material and for similar uses. The Engineer may order the use of gravel for purposes other than those specified if, in his opinion, such use is advisable.

2D-2 BANK-RUN GRAVEL

Bank-run gravel shall consist of hard, durable stone and coarse sand, essentially free from frost, frozen lumps, loam and clay, uniformly graded and containing no stone having any dimension greater than 3-in. The grading of sizes and material shall be such that the gravel may be thoroughly consolidated.

25 to 70% shall pass the No. 4 sieve and not more than 12% of the material passing the No. 4 sieve shall pass the No. 200 sieve.

2D-3 SCREENED GRAVEL

Screened gravel conforming to ASTM C33 stone size No. 67, shall consist of hard, durable, round particles of proper size and gradation, and it shall be free from sand, loam, clay excess fines, and deleterious materials. The size of the particles shall be uniformly graded gravel such that not less than 130 per cent of the particles will pass a 3/4-in sieve and not more than 5 percent will pass a No. 4 sieve. Quality and gradation shall be acceptable to the Engineer.

SECTION 2E

ROCK AND BOULDER EXCAVATION

2E-1 SCOPE OF WORK

This section includes the excavation, disposal and replacement of rock and boulders.

2E-2 DEFINITIONS

Rock excavation shall mean rock which, in the opinion of the Engineer, requires for its removal drilling and blasting.

Boulder excavation shall mean boulders exceeding 1/2 cu. yd. in volume which can be excavated without resorting to blasting.

2E-3 BLASTING

A11 blasting operations shall be conducted in full compliance with all laws of the State, local ordinances, and regulations and with all possible care to avoid injury to persons and property.

2E-4 DISPOSAL AND REPLACEMENT OF ROCK

Rock and boulders exceeding 6 inches in diameter, shall not be used for backfilling. Rock disposed of shall be replaced by surplus excavation or borrow.

DIVISION 3 - SANITARY SEWERS

SECTION 3A

ASBESTOS-CEMENT SEWER PIPE

3A-1 SCOPE OF WORK

This section includes furnishing asbestos-cement pipe and fittings for sanitary sewers as shown on the contract drawings.

3A-2 ASBESTOS-CEMENT PIPE

Asbestos-cement sewer pipe and fittings shall conform to ASTM Specifications for Asbestos-cement Non-Pressure Sewer Pipe, Designation C-644, Type II. Manufacturer's certificate of compliance shall be furnished to the Engineer, prior to installation. Methods of shipping and storage on site shall be such as to avoid injury to the pipe. Damaged pipe shall be rejected and removed from the job site.

Asbestos-cement pipe and fittings shall be Class 3300, unless otherwise noted on the plans.

Each length of pipe shall be marked with the nominal size, the class, the name of the manufacturer or his trademark, and the date of manufacture. All parts of sleeve couplings shall be marked with the manufacturer's identification, size, and class of pipe for which it is intended.

3A-3 ASBESTOS-CEMENT FITTINGS

Wye branches and bends shall be standard with the manufacturer, and of the same class and type as the pipe on which they are used.

3A-4 JOINTS FOR ASBESTOS-CEMENT PIPE

Joints shall be of the sleeve-coupling type conforming to ASTM specifications C-644, Type II. Compression rings shall be of Oil Resistant rubber type of elastomeric material and shall conform to ASTM Specifications D-1869. Manufacturer's instructions for installation shall be followed.

SECTION 3B

VITRIFIED CLAY SEWER PIPE

3B-l SCOPE OF WORK

This section includes furnishing vitrified clay sewer pipe and fittings as shown on the contract drawings.

3B-2 VITRIFIED CLAY PIPE

Vitrified clay pipe for sizes 8", 10", and 15" shall conform to the requirements of NCPI Specifications for 3300 Lbs. L.F. Crushing Strength vitrified clay pipe, Designation ER 3300. For other sizes, pipe shall conform to the requirements of ASTM Specifications for Extra Strength clay pipe as described in ASTM Specifications for Extra Strength and Standard Strength Clay Pipe and Perforated Clay Pipe, Designation C700 or any subsequent additions. Manufacturer's certificate of compliance shall be furnished to the Engineer, prior to installation. Methods of shipping and storage on site shall be such as to avoid injury to the pipe. Damaged pipe shall be rejected and removed from the job site.

3B-3 VITRIFIED CLAY FITTINGS

Wye branches and bends shall be standard with the manufacturer, and of the same type as the pipe on which it is used. Each wye branch shall be provided with a clay plug. Clay plugs shall have watertight preformed joints installed without adhesive in the wye branch.

38-4 JOINTS FOR VITRIFIED CLAY PIPE

Joints shall be made with Oil Resistant compression rings in accordance with ASTM C-425, Type III Manufacturer's instructions for installation shall be followed.

SECTION 3C

P.V.C. SEWER PIPE

3C-1 GENERAL

P.V.C. sewer pipe is approved only for areas receiving domestic sewage and is not approved for areas receiving predominantly industrial waste.

Approved sizes are 4, 6, S, 10, 12, and 15 inches.

3C-2 SCOPE OF WORK

This section includes furnishing P.V.C. (Poly Vinyl Chloride) sewer pipe and fittings as shown on the contract drawings.

3C-3 P.V.C. (P0LY VINYL CHLORIDE) PIPE

All P.V.C. (Poly Vinyl Chloride) pipe and fittings shall conform to the most recent requirements of ASTM Specifications for Type PSM Poly Vinyl Chloride (P.V.C.) Sewer Pipe and Fittings.

P.V.C. Pipe conforming to Designation D-3034 shall be SDR-35 only.

P.V.C. Pipe conforming to Designation F-789 shall be PS-46. A11 P.V.C. Pipe shall have elastomeric gasket joints and which joints shall conform to ASTM Specifications for sewer pipe joints using Elastomeric Seals Designation D-3212. Manufacturer's certificate of compliance shall be furnished to the Engineer, prior to installation. Methods of shipping and storage on site shall be such as to avoid injury to the pipe. Damaged pipe shall be rejected and removed from the job. Solvent cement joints shall not be allowed.

Minimum "pipe stiffness" (F/y) at 5% deflection shall be 46 psi for all sizes when tested in accordance with ASTM Method of Test D-2412, "External Loading Properties of Plastic Pipe by Parallel - Plate Loading."

Each length of pipe in compliance with this specification shall be clearly marked at intervals of 5 feet or less. Pipe conforming to designation D3034 shall be marked with the manufacturer's name or trademark, nominal pipe size, the P.V.C. cell classification (i.e., 12454-\B), the legend "Type PSM SDR-35 P.V.C. Sewer Pipe," and "ASTM D-3034." Pipe conforming to Designation F-789 shall be marked with the manufacturer's name or trademark, the P.V.C. cell classification (i.e. 12164-8), Modulus indicator (i.e. T-l, T-2, or T-3), the legend "PS-46 P.V.C. Gravity Sewer Pipe," and "ASTM F-789."

P.V.C. pipe used for force main shall conform to ASTM D-2241 and D-1784 (Class 12454-B) and safety factor of 2.5 shall be used for pressure rating determination with a standard dimension ratio (SDR) no higher than 26.

3C-4 P.V.C. FITTING8

Wye branches and bends shall have elastomeric gasket joints, and conform to "ASTM D-3034" (SDR-35 only) or ASTM P-789. They shall be manufactured and furnished by the pipe supplier (or approved equal) and have bell and spigot joints compatible with that of the pipe.

Each fitting in compliance with this specification shall be clearly marked with manufacturer's name or trademark, nominal size, material designation "P.V.C.", "PSM" (for SDR-35 only), and "ASTM D-3034" or "ASTM F-789". All fittings shall be either SDR-35 or PS-46 and shall be the same as the pipe being used."

3C-5 JOINTS FOR P.V.C. PIPE

Joints shall be of the bell and spigot type with a gasket as previously specified. No solvent joints are permissible. Manufacturer's instructions shall be followed.

3C-6 ALLOWABLE DEFLECTION

A maximum of 7-l/2% deflection in the pipe diameter will be allowed. Deflection shall be measured as the reduction in the vertical diameter of the pipe.

SECTION 3D

REINFORCED CONCRETE-SEWER PIPE

3D-1 SCOPE OF WORK

This section includes furnishing reinforced concrete sewer pipe and fittings as shown on the contract drawings.

3D-2 REINFORCED CONCRETE PIPE

Reinforced concrete sewer pipe and fittings shall conform to ASTM Specifications for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe, Designation C-76. Cement shall be Type II, in conformance with ASTM Specification C-150. Manufacturer's certificate of compliance shall be furnished to the Engineer, prior to installation. Methods of shipping and storage on site shall be such as to avoid injury to the pipe. Damaged pipe shall be rejected and removed from the job site.

Reinforced concrete pipe and fittings shall be Class IV, Wall B, unless otherwise noted on plans.

Each length of pipe shall be marked with the manufacturer, class, and date of manufacturer. Pipe shall not be shipped until it has aged for at least 7 days or attained a minimum strength of 4000 psi, whichever takes longer.

3D-3 REINFORCED CONCRETE FITTINGS

Wye branches and bends shall be standard with the manufacturer, and of the same class and type as the pipe on which they are used.

3D-4 JOINTS FOR REINFORCED CONCRETE PIPE

Joints shall be made with Oil Resistant compression rings of an elastomeric material conforming to ASTM C-443. Manufacturer's instructions shall be followed.

SECTION 3E

CEMENT LINED DUCTILE IRON SEWER PIPE

3E-l SCOPE OF WORK

This section includes furnishing cement lined ductile iron pipe and fittings as shown on the contract drawings.

3E-2 CEMENT LINED DUCTILE IRON PIPE

Cement lined ductile iron pipe and fittings shall conform to ANSI Standards A21.50 and A21.51. Cement-mortar lining shall be double thickness and conform to ANSI A21.4. Manufacturer's certificate of compliance shall be furnished to the Engineer, prior to installation. Methods of shipping and storage on site shall be such as to avoid injury to the pipe. Damaged pipe shall be rejected and removed from the job site.

Cement lined ductile iron pipe and fittings shall be Class 50, unless otherwise noted on the plans.

Each length of pipe shall be marked with the manufacturer, trade name, and class.

3E-3 CEMENT LINED DUCTILE IRON FITTINGS

Fittings shall conform to ANSI A21.11 and shall be of the same class and type as the pipe on which they are used.

3E-4 JOINTS FOR CEMENT LINED DUCTILE IRON PIPE

Joints shall be rubber gasket, oil resistant, Joints of the push-on type in conformance with ANSI AWWA C-lll (A21.11). Manufacturer's instructions shall be followed.

SECTION 3F

INSTALLATION OF SEWER PIPE

3F-1 PIPE HANDLING

The Contractor shall arrange for the delivery of the pipe sections at approved locations in the vicinity of that portion of the sewer line in which the pipe sections are to be laid. To this end, he shall do such work as is necessary for access and for delivery of the pipe. Pipes shall be stored in an approved, orderly manner so that there will be a minimum of re-handling from the storage area to the final position in the trench and so that there is a minimum of obstruction and inconvenience to any kind of traffic. Deliveries shall be scheduled so that the progress of the work is at no time delayed and also so that large quantities of pipe shall not be stored for excessive lengths of time in crowded locations or in locations where large storage areas might be considered objectionable. Storage of pipe will be restricted to approved or permitted areas.

The spigot end of all pipes shall be stored on a block to prevent damage. The bell or groove end of each length of R.C. pipe shall be placed in storage on a block to prevent damage. Care shall be taken that the lengths do not roll together.

Each pipe section shall be handled into its position in the trench in such manner and by such means as the Engineer approves as satisfactory, and these operations will be restricted to those considered safe for the workmen and such as to cause no injury to the pipe or to any property.

The Contractor will be required to furnish slings, straps and/or approved devices to provide satisfactory support of the pipe when it is lifted. Transportation from delivery areas to the trench shall be restricted to operations which can cause no injury to the pipe units.

The pipe shall not be dropped from trucks or into the trench

The Contractor shall have on the job-site with each pipe-laying crew all the proper tools to handle and cut the pipe. The use of hammer and chisel, or any other method which results in rough edges: chips and damaged pipe, shall be prohibited.

Damaged pipe coating and/or lining shall be restored before installation is approved or directed by the Engineer.

3F-2 CONTROL OF ALIGNMENT AND GRADE

The location of the pipe, manholes, and other appurtenances shall be established in accordance with the contract drawings. Bench marks shall be established along the route of the pipeline at convenient intervals for use in checking the pipe and manhole invert and other elevations throughout the project.

The Contractor may use a laser beam to assist in setting the pipe provided he can demonstrate satisfactory skill in its use.

The use of string levels, hand levels, carpenters levels or other relatively crude devices for transferring grade or setting pipe will not be permitted.

3F-3 PREPARATION OF BED

As soon as excavation has been completed to proper depth, as shown on the Standard Trench Section, a layer of bedding material shall be placed to the elevation necessary to bring the pipe to grade and compacted. It shall be the Contractor's responsibility to control any water in the trench below the pipe invert. If directed by the Engineer, the contractor shall place concrete, clay or other impermeable material in the bedding at intervals to prevent horizontal movement of the groundwater which might induce settling of the bed, or make it difficult to handle water in the trench.

3F-4 LAYING PIPE

Each pipe length shall be inspected for cracks, defects in coating or lining, and any other evidence of unsuitability

Pipe shall be laid in the road and at no time shall water in the trench be permitted to flow into the sewer.

The pipe shall then be laid on the trench bedding as shown on the Standard-Trench Section, and the spigot pushed home. Jointing shall be in accordance with the manufacturer's instructions and appropriate ASTM Standards, and the Contractor shall have on hand for each pipe-laying crew, the necessary tools, gauges, pipe cutters, etc., necessary to install the pipe in a workmanlike manner. Pipe laying shall proceed upgrade with spigot ends pointing in the direction of flow, unless otherwise approved by the Engineer.

Blocking under the pipe will not be permitted except where a concrete cradle is proposed, in which case pre-cast concrete blocks shall be used.

After the pipe has been set to grade, additional bedding material shall be placed in 6-inch layers up to the spring line of the pipe. Tamping bars shall be carefully employed to assure compaction of the bedding under the lower quadrants of the pipe.

After this, the sand blanket shall be carefully placed in 6-inch layers to a depth of 12 inches over the crown of the pipe. Each layer shall be thoroughly compacted with mechanical equipment. Care shall be taken that the equipment does not damage the pipe.

At this point, the pipe shall be checked for line and grade and any debris, tools, etc., shall be removed.

If inspection of the pipe is satisfactory, the Contractor may then refill or backfill the remainder of the trench in accordance with the Standard Trench Section.

At any time that work is not in progress, the end of the pipe shall be suitably closed to prevent the entry of animals, earth, etc.

At the end of each day's work or at intervals of no more than 200 feet of pipe, the Engineer, with the Contractor, will inspect the pipe for alignment with lamps or mirrors. Unsatisfactory work shall be dug up and re-installed to the satisfaction of the Engineer.

SECTION 3G

SEWER SERVICE CONNECTIONS

3G-1 SCOPE OF WORK

This section includes furnishing and installing service connections from the sewer to the sideline of the street or easement as shown on the contract drawings.

3G-2 MATERIALS

Materials for house services, wye branches, and chimneys shall be of the same material and quality as that for the main sewer. Concrete for encasement shall be Class A (3000 psi) concrete.

3G-3 INSTALLATION

Installation shall be as shown on the "House Sewer Details." House services shall not be connected directly to manholes. The opening of the house service, wye branch, or chimney shall be plugged with a suitable watertight cap or plug.

The minimum size for the house sewer shall be 6".

The minimum slope for the house sewer shall be 1/4" per foot, unless otherwise approved by the Engineer.

Before backfilling, the Contractor shall notify the Inspector so that he may make the necessary measurements to locate the opening later. In addition, an approved ferrous rod or pipe shall be placed over the plugged opening at the property line, extending to within 2 inches of the final ground surface.

3G-4 SADDLE CONNECTIONS

On asbestos-cement, vitrified clay, reinforced concrete, and cement lined ductile iron sewers, saddle connections may be installed in lieu of wye branches using cast iron branch connections conforming to ASTM A-48, Class 50. These connections shall be fastened by a stainless steel strap, stainless steel nuts and bolts, and watertight gasket between the main pipe and the fitting, and shall have a rubber gasket providing a watertight seal with the service pipe. Holes shall be made only in a manner recommended by the pipe manufacturer and approved by the Engineer. The hole in the main must be the full diameter of the inside of the fitting to prevent obstructing the flow. The entire connection must be watertight.

On P.V.C. sewer, saddles may be used in lieu of wye branches using injection-molded rubber-gasketed wye saddles conforming to ASTM D-3034 and 3212. Saddles shall be cut into the pipe according to manufacturer's details and procedures. Connections shall be fastened by (2) stainless steel clamps tightened to a minimum torque of 5 ft.-lbs. The use of solvent weld sewer saddle connections is prohibited. The entire connection must be watertight.

SECTION 3H

PROXIMITY TO WATER MAINS

The New Hampshire Department of Environmental Services, Water Supply and Pollution Control Division's Standards of Design dated July 1990 require a 10 foot horizontal separation between water and sewers lines, and an 18" vertical separation wherever water and sewer lines cross.

However, should construction operations reveal or expose a waterline main or service running approximately parallel and less than 10 feet horizontally from the proposed sewer installation and where it is not practicable to relocate the sewer, the following methods of protection must be employed:

If the above separation cannot be achieved, the sewer shall be encased in concrete, as shown on these drawings, or else ductile iron pipe of the same size shall be utilized. Appropriate manufactured fittings shall be employed to adapt the iron pipe to the contract sewer pipe.

Whenever the waterline crosses over the new sewer with less than 18 inches of separation, the sewer pipe for a distance of 9 feet on each side of the waterline shall be Class 52 Ductile Iron Pipe. Appropriate manufactured fittings shall be employed to adapt the iron pipe to the contract sewer pipe. As an alternative, the waterline may be raised, if feasible, to achieve the required separation.

Should the waterline in either situation be at or below the sewer elevation, the waterline or the sewer must be relocated to achieve 10 ft. separation or the waterline raised.

SECTION 3I

MANHOLES

3I-1 GENERAL

The work covered by this section includes the furnishing of all plant, labor, equipment, appliances, and materials, and performing all operations in connection with the satisfactory installation of manholes, and all incidental work, complete, in strict accordance with the specifications and applicable drawings and standard details.

The contractor shall provide the Engineer with shop drawings of all pre-cast material and a description of all methods of Jointing he proposes to use on this portion of the contract.

It is the intention of these specifications that the manhole, including all component parts, have adequate space, strength and leakproof qualities considered necessary for the intended service. Space requirements and configurations shall be as shown on the drawing. Manholes may be an assembly of pre-cast sections with or without steel reinforcement, with approved jointing, or concrete cast monolithically in place with or without reinforcement.

In any approved manhole, the complete structure shall be of such material and quality as to withstand loads of 8 tons (H20 loading) without failure and prevent leakage in excess of one gallon per day per vertical foot of manhole, continuously for the life of the structure. A period generally in excess of 25 years is to be understood in both cases. It is further intended that any pointing of joints shall be accomplished after leakage tests have been satisfactorily completed.

3I-2 DESCRIPTION

Manholes shall be constructed at the locations, to the elevations, and in accordance with notes and details show on the drawings as well as the standard details, Appendix A.

Manholes shall be as shown on the standard details and shall conform to the following:

1. **Barrels and cone sections shall be pre-cast reinforced or nonreinforced concrete, or cast-in-place reinforced or non-reinforced concrete.**

2. **Base sections shall be monolithic to a point 6" above the crown of the incoming pipe, and shall be pre-cast reinforced concrete or pre-cast non-reinforced concrete or cast-in-place concrete.**

3. **Horizontal joints between sections of pre-cast concrete barrels shall be of an overlapping type and, shall, in general, depend for watertightness upon an elastomeric or mastic-like sealant.**

4. **Pipe to manhole Joints shall depend for water-tightness upon either an approved non-shrinking mortar, elastomeric sealant, or elastomeric, rubber, sleeve with watertight joints at the manhole opening and pipe surfaces.**

5. **Cone sections shall be eccentric – see standard detail.**

6. **There shall be no manhole steps.**

7. **All pre-cast sections and bases shall have the date of manufacture and the name or trademark of the manufacturer impressed or indelibly marked on the inside wall.**

3I-3 MATERIALS

Concrete for cast-in-place bases or complete manholes shall conform to the requirements for Class A concrete in Section 520 of the New Hampshire Department of Transportation Standard Specifications.

Reinforcing steel for cast-in-place concrete shall conform to the requirements of Section 544 in the New Hampshire Department of Transportation Standard Specifications for Billet-steel bars or Welded Steel Wire Fabric.

Pre-cast concrete barrel sections, cones, and bases shall conform to ASTM C-478 except as may be otherwise shown on the Standard Details.

Manhole frame and cover shall provide a 30" diameter clear opening. The cover shall have the letter "S" or the word "SEWER" in 3" letters cast into the top surface. Covers shall have two lift holes, 180 degrees apart, on the perimeter.

The castings shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended. Contact surfaces of covers and frame seats shall be machined at the foundry, before shipment to prevent rocking of covers in any orientation.

All castings shall be thoroughly cleaned and subject to a careful hammer inspection.

Castings shall be at least Class 30 conforming to the ASTM Standard Specification for Gray Iron Castings, Designation A48.

Before being shipped from the foundry, castings shall be sandblasted and given two coats of coal-tar-pitch varnish, applied in a satisfactory manner so as to make a smooth coating, tough, tenacious, and not brittle or with any tendency to scale off.

3I-4 INSTALLATION OF MANHOLE BASES AND SECTION

Pre-cast bases shall be placed on a 6" layer of compacted bedding material as described below. The excavation shall be properly de-watered while placing bedding material and setting the base or pouring concrete. Water-stops shall be used at the horizontal joint of cast-in-place manholes.

Inlet and outlet stub's shall be connected and sealed in accordance with the manufacturers recommended procedure, and as shown on the Standard Details, or cast integrally with the cast base.

Barrel sections and cones of the appropriate combination of heights shall then be placed, using manufacturers recommended procedure for sealing the horizontal joints, and as shown on the Standard Details or the remaining barrel of the manhole shall be cast above the base.

A leakage test shall then be made.

Following satisfactory completion of the leakage test, the frame and cover shall be placed on the top or some other means of preventing accidental entry by unauthorized persons, children, animals, etc., until the Contractor is ready to make final adjustment to grade.

Bedding Material shall consist of crushed stone and/or natural stone graded to the following specifications:

100% passing	1" screen	Equivalent to Standard Stone
90-100% passing	3/4" screen	size #67 Section 703 of
20-55% passing	3/8" screen	NH DOT Standard Specifications
0-10% passing	#4 sieve	
0-5% passing	#8 sieve	

3I-5 BRICK MASONRY

This section applies to brick masonry, for the shelf, invert, and grade adjustment.

Brick: The brick shall be sound, hard, and uniformly burned brick, regular and uniform in shape and size, of compact texture, and satisfactory to the engineer. Brick shall comply with the ASTM Standard Specifications for Sewer Brick (made from clay or shale), Designation C32, for Grade SS, hard brick.

Rejected brick shall be immediately removed from the work.

Mortar: The mortar shall be composed of portland cement, hydrated lime, and sand, in the proportions of 1 part cement to 1/2 part lime to 4-1/2 parts sand, (by volume). The proportion of cement to lime may vary from 1:1/4 for hard brick to 1:3/4 for softer brick, but in no case shall the volume of sand exceed three times the sum of the volume of cement and lime.

Cement shall be Type II portland cement conforming to ASTM C-150, Standard specifications for Portland Cement.

Hydrated lime shall be Type S conforming to the ASTM Standard Specification for Hydrated Lime for Masonry Purposes, Designation C207.

Sand shall consist of inert natural sand conforming to the ASTM Standard Specifications for Concrete (Fine) Aggregates, Designation C33 as follows:

GRADING:

Sieve	Percent Passing
# 3/8	100
4	95 - 100%
8	80 - 100%
16	50 - 85%
50	10 - 30%
100	2 - 10%

Fineness Modulus 2.3 - 3.1

Laying Brick: Only clean bricks shall be used in brickwork for manholes. The brick shall be moistened by suitable means, as directed, until they are neither so dry as to absorb water from the mortar nor so wet as to be slippery when laid.

Each brick shall be laid in a full bed and joint of mortar without requiring subsequent grouting, flushing, or filling, and shall be thoroughly bonded as directed.

Curing: Brick masonry shall be protected from too rapid drying by the use of burlaps kept moist, or by other approved means, and shall be protected from the weather and frost, all as required.

3I-6 SETTING MANHOLE FRAMES AND COVERS

Manhole frames shall be set with the tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the drawings. Frames shall be set concentric with the top of the masonry and in a full bed of mortar so that the space between the top of the manhole masonry and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the masonry shall be placed all around and on the top of the bottom flange. The mortar shall be smoothly finished and have a slight slope to shed water away from the frame.

Manhole covers shall be left in place in the frames on completion of other work at the manholes.

A minimum of 8" and a maximum of 12" of brick and mortar shall be allowed for grade adjustment.

SECTION 3J

FINAL SEWER TESTS

3J-1 GENERAL

A. Work Included

1. **Final sewer testing work includes the performance of testing and inspecting each and every length of sewer pipe and each item of appurtenant construction.**

2. **Perform testing at a time approved by the Engineer, which may be during the construction operations, after completion**

of a substantial and convenient section of the work, or after the completion of all pipe laying operations.

3. Provide all labor, pumps, pipe, connections, gauges, measuring devices and all other necessary apparatus to conduct tests.

3J-2 PERFORMANCE

A. General

1. All sewers, manholes, appurtenant work, in order to be eligible for approval by the Engineer, shall be subjected to tests that will determine the degree of watertightness, horizontal and vertical alignment, and deflection (P.V.C. sewers only).

2. Thoroughly clean and/or flush all sewer lines to be tested, in a manner and to the extent acceptable to the Engineer, prior to initiating test procedures.

3. Perform all tests and inspections only under the direct supervision of the Engineer.

4. Perform Testing by test patterns determined or approved by the Engineer.

5. Remedial Work:

   a. Perform all work necessary to correct deficiencies discovered as a result of testing and/or inspections.
   b. Completely re-test all portions of the original construction on which remedial work has been performed.
   c. Perform all remedial work and re-testing in a manner and at a time approved by the Engineer.

B. Leakage Tests (Gravity Sewers):

1. Test all gravity sewer lines for leakage by conducting low pressure air tests conforming to ASTM C828 after the installation of house service fittings and leads and after completely backfilling the sewer line trench.

2. Equipment
   a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.

b. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

c. All air used shall pass through a single central panel.

d. Connect 3 individual hoses:

(1) From the control panel to the pneumatic plugs for inflation.

(2) From the control panel to the sealed sewer line for introducing the low pressure air.

(3) From the sealed sewer line to the control panel for continually monitoring the air pressure rise in the sealed line.

3. Groundwater Conditions:

a. In areas where groundwater exists, and at the time of installing the sewer line, install a 1/2-inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one of the sewer lines entering the manhole.

b. Immediately prior to performing the line acceptance test, determine the groundwater by removing the pipe cap, blowing air through the pipe nipple into the ground to clear it, and then connecting a clear plastic tube to the nipple.

c. Hold the tube vertically and measure the height in feet. Divide this height by 2.3 to establish the pounds of groundwater pressure to be added to the air pressure test readings. (Example: Height of water is 11 1/2 feet, added groundwater pressure is 5 psig, minimum air pressure is 2.5 psig; therefore, the total minimum acceptable pressure is 7.5 psig).

4. Testing Pneumatic Plugs:

a. Seal test all pneumatic plugs prior to using them in the actual test.

b. Lay one length of pipe on the ground and seal both ends with the pneumatic plugs to be tested.

c. Pressurize the sealed pipe to 5 psig.

d. The pneumatic plugs are acceptable if they remain in place without bracing.

5. Testing Sewer Pipeline:

a. After the trench has been backfilled, the sewer pipe cleaned and the pneumatic plugs checked, place the plugs in the sewer line at each manhole and inflate them.

b. Introduce low pressure air into the sealed sewer pipeline until the air pressure reaches 4 psig greater than the average groundwater pressure.

c. Allow a minimum of 2 minutes for the air pressure to stabilize to a minimum of 3.5 psig greater than the ground-water pressure.

d. After the stabilization period, disconnect the air hose from the control panel to the air supply.

e. The pipeline will be acceptable if the pressure decrease is not greater than l/2 psig in the time stated in the following table

Pipe Diameter (inches)	Time (minutes)
4	2.0
6	3.0
8	4.0
10	5.0
12	5,5
14	6.5
15	7.0
16	7.5
18	8.5
20	9.5
21	10.0
24	11.5
27	12.5
30	14.0
36	17.0

6. Testing Force Mains:

a. Force mains shall be tested in accordance with Section 4 of American Water Works Association Standard C600 "Installation of Cast Iron Water Mains", at a pressure

equal to 150% of the design operating total dynamic head.

7. Test Results:

a. If the installation fails the low pressure air test, determine the source of leakage.
b. Repair or replace all defective materials and/or workmanship and repeat low pressure air test.

C. Deflection Tests (P.V.C. Sewers Only)

1. Test all P.V.C. Sewer lines for deflection by conducting deflection tests using a rigid "Go-No Go" deflection gauge made as recommended by Johns-Manville or by an approved deflectometer.

2. The acceptance limit for deflection tests of installed PVC Pipe Designation D-3034 and F-789, 4"-15" diameters, shall be 7-1/2% of the average inside diameter of the pipe. A test shall be conducted after a minimum of 30 days following their installation.

3. Go-No Go Device

a. Pull a line through the pipe with which to pull the Go-No Go device using one of the following methods:
(1) Attach the pull line to the nozzle end of a hydro cleaner before the cleaning cycle starts. As the hose is pulled through the line, it will carry the pull line to the next manhole where it can be tied off.
(2) A parachute device can be blown through the line with a lightweight string attached. The pull line can then be attached to the string and pulled manually through the line.
(3) If water is available, a lightweight string can be floated through the pipe. The pull line can then be attached to the string and pulled manually through the line.
b. Attach a pull line to each end of the device to facilitate removal if an obstruction is encountered.
c. Pull the gauge through the line by hand using a smooth and easy motion.
d. If an obstruction is encountered, pull lightly to see if the gauge will clear the obstruction.
e. If the gauge will not clear the obstruction, record the distance from the manhole and pull the gauge back out.

4. **Repair or replace all defective materials and/or workmanship and repeat the deflection test on the repaired line.**

D. Alignment Tests (Gravity Sewers):

1. **Perform tests for the correctness of horizontal and vertical alignment on each and every length of gravity sewer pipeline between manholes.**
2. **Beam a source of light, acceptable to the Engineer, through the pipeline and directly observe the light in the manhole at the opposite end of each test section.**

E. Inspection of Appurtenant Installations:

1. **Completely inspect, at a time determined by the Engineer, all manholes and inlets to ascertain their compliance with the Drawings and Specifications.**
2. **Provide access to each manhole and inlet and check the following characteristics:**
   a. **Shape and finish of invert channels,**
   b. **Watertightness and finish of masonry structures,**
   c. **Location, type, and attachment of stops,**
   d. **Elevation and attachment of frames, covers, and openings.**
   e. **Pattern and machining of covers**
   f. **Drop connection arrangements.**

F. Manhole Leakage Tests

1. **Observation:**
   a. **Test manholes prior to backfilling, mortaring joints, and installing the bench and inverts.**
   b. **When the groundwater is below the bottom of the manhole, perform an exfiltration test by plugging all pipes and other openings and filling the manhole with water to the top of the cone section. After 15 minutes, if there is no visible leakage (no water visibly moving down the surface of the manhole) the manhole shall be considered watertight and backfilling may proceed.**
   c. **When the groundwater is above the bottom of the manhole, perform an infiltration test on that portion of the manhole below the groundwater level. After 15 minutes, if there is no visible leakage into the manhole, that portion of the manhole below the groundwater shall be considered watertight After the infiltration test has been completed, fill the manhole with water and perform an exfiltration test on that portion of the manhole above the groundwater.**

d. Any visible leakage into and out of manholes shall be considered unsatisfactory.

2. Drop in Water Level:

a. Under certain circumstances such as an area with a heavy flow of traffic, and with approval by the Engineer, a manhole may be tested by measuring the drop in water level after backfilling.

b. Prior to mortaring joints and installing the bench and invert, fill the manhole to the top of the cone and compute the leakage by measuring the drop in water level over a period of not less than 8 hours.

c. Leakage shall not exceed 1 gallon per vertical foot for a 24 hour period.

3. As an alternative to the above tests, a vacuum pressure test may be carried out to the following criteria:

a. Initial vacuum gage test pressure shall be 10" Hg. Test hold time for a 1" Hg. pressure drop to 9" Hg shall be:

(1) At least 2 minutes for 10 feet deep manholes;
(2) At least 2-1/2 minutes for 10-15 feet deep manholes; and
(3) At least 3 minutes for 15-25 feet deep manholes.

a. If the pressure drop exceeds the above limits the unit shall be repaired and re-tested and if a unit fails to meet a 1" pressure drop in 1 minute, the unit shall be water tested per (1) or (2) above.

3. Correct all leakage by reconstruction using new materials. Using leadwool, expanding mortar, and other repair methods shall not be permitted.

G. Re-testing Approved Lines

1. Prior to the final acceptance of any sewer lines, the Engineer may require re-testing of up to 10% of all lines installed when more than 30 days have lapsed from the time of initial testing or, if in the opinion of the Engineer, sufficient reason exists to suspect settling has occurred.

2. If, during such re-testing, any lines are found to exceed the 7.5% maximum deflection, the Engineer may require all lines to be re-tested.

DIVISION 4 – STORM DRAINS

SECTION 4A

REINFORCED CONCRETE DRAINS

4A-1 SCOPE OF WORK

This section includes furnishing reinforced concrete drainage pipe as shown on the contract drawings.

4A-2 REINFORCED CONCRETE PIPE

Reinforced concrete drain pipe shall conform to ASTM Specifications for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe, Designation C-76. Reinforcement shall be circular for all concrete pipe. Reinforcement shall be of the cross-sectional areas as specified in ASTM C-76. Longitudinal and circular reinforcement shall extend into bells, grooves, and tongues. Manufacturer's certificate of compliance shall be furnished to the Engineer, prior to installation. Methods of shipping and storage on site shall be such as to avoid injury to the pipe. Damaged pipe shall be rejected and removed from the job site.

Reinforced concrete pipe shall be Class IV, Wall B, unless otherwise noted on the plans.

Each length of pipe shall be marked with the manufacturer, class, and date of manufacture. Pipe shall not be shipped until it has aged 7 days or attained a minimum strength of 4000 psi, whichever takes longer.

4A-3 JOINTS FOR REINFORCED CONCRETE PIPE

Joints for concrete pipe shall be standard bell and spigot or tongue and groove.

Bell and spigot pipe joints shall be made by caulking all around with twisted jute of proper size to give good alignment of the pipe. Inner surfaces of abutting sections shall be flush and in a smooth grade. Brush and wet the jointing surfaces, and then fill the annular opening with mortar to a minimum depth of 2-in, sufficient to form a bead around the outside face of the bell.

Tongue and groove joints shall be made by brushing and wetting the jointing surfaces, buttering the spigot with mortar and pushing it home. The opening between the pipes shall then be completely filled with mortar, both inside and outside on pipes 45-in and larger, outside on pipes 42-in and smaller.

Mortar for jointing shall consist of one part portland cement and two parts sand, using a minimum amount of water sufficient to make a workable mortar.

Joints shall be immediately protected from freezing or excessive drying by covering with earth, burlap, or other approved material.

4A-4 INSTALLATION

Brain pipe shall be laid true to line and grade as shown on the plans and in accordance with the instructions of the manufacturer.

Bedding shall consist of carefully preparing and shaping a bed of fine granular material to fit the lower l5 percent of the external height of the pipe with a minimum of 4" under the bottom of the pipe. Recesses shall be excavated for the bells of the pipe.

As soon as the excavation is completed and the specified pipe bedding provided, the Contractor shall firmly bed the pipe to conform accurately to the line and grade indicated on the plans. No blocking will be permitted under the pipe.

As soon as the pipe is in place, fine granular material shall be placed and compacted to the mid-diameter of the pipe.

The remaining backfill shall be in accordance with Section 2B.

4A-5 TESTING AND CLEANING

At the conclusion of the work, the Contractor shall thoroughly clean all of the new drains by flushing with water or other means to remove all dirt, stones, pieces of wood, or other debris, which may have entered during the construction period. Debris cleaned from the lines shall be removed from the lowest manhole. If, after this cleaning any obstructions remain, they shall be removed to the satisfaction of the Engineer. When groundwater level is above the pipe, or following a heavy rain, the Engineer will examine the pipe for leaks. If any defective pipes or joints are discovered, they shall be repaired or replaced.

SECTION 4B

DRAINAGE STRUCTURES

4B-1 SCOPE OF WORK

This section shall include manholes and catch basins constructed of cast-in-place concrete, concrete block, or precast sections.

4B-2 CAST-IN-PLACE CONCRETE

Cast-in-place structures shall be made with concrete conforming to the requirements for Class A concrete in Section 520 of the New Hampshire Department of Transportation Standard Specifications.

4B-3 REINFORCING STEEL

Reinforcing steel for cast-in place concrete shall conform to the requirements of Section 544 in the New Hampshire Department of Transportation's Standard Specifications for Billet-steel bars or Welded Steel Wire Fabric.

4B-4 BRICK MASONRY

Brick masonry shall be in conformance with Section 3I-5.

4B-5 CONCRETE BLOCK MASONRY

Precast solid concrete blocks may be rectangular for drain inlets or radial and battered for manholes and shall conform to ASTM specification C-139. Blocks shall have maximum lengths of eighteen (18) inches, minimum width of eight (8) inches, and height not greater than eight (8) inches.

Radial blocks must be made in true segments of a circle with inside and outside surfaces curved to the desired radius. The units in the cone section of the manhole shall be drawn in (reduced) eight (8) inches for every eight (8) in height. The unit shall be so designed that the interior surfaces of manholes are cylindrical for straight sides and conical for the top three courses with no offsets.

Units for both manholes and inlets must be so designed that only full length units are required to lay any one course.

All blocks shall be free from noticeable cracks, pits, damaged corners, and other imperfections. Textures shall be uniform and shall conform to samples submitted to and approved by the Engineer.

Mortar for concrete block shall be as specified for Brick Masonry in Section 3I-5.

4B-6 PRECAST CONCRETE SECTIONS

Precast concrete sections shall be manufactured to the dimensions as detailed in the plans and shall conform to ASTM Specification C-478 as applicable and the following additional requirements:

The barrels of manholes shall be 48-in. inside diameter with a wall not less than 5-in., and 60-in. inside diameter with a wall not less than 6in. with tongue and groove joints. Precast bases shall be a minimum of 5-in. thick.

Precast tops shall have 30-in. diameter openings as required.

Inverts of precast bases to be shaped with concrete fill in the field. A channel shall be formed for the lower 10% of the pipe with the top of the shelf 1" above the top of the channel.

Drawings and specifications shall be submitted for approval for all types of precast units to be furnished. Drawings shall indicate all dimensions and reinforcing steel areas and concrete design strength.

Precast concrete manhole sections shall be set so as to be vertical and with sections in true alignment, 1/4-in. maximum tolerance to be allowed. Joints for tongue and groove sections shall be completely mortared by buttering the groove end immediately prior to setting a section. The outside and inside joint shall then be completely filled with a comparatively dry mortar (one part cement to two parts sand) and finished flush with the surfaces of the bell. Allow joints to set for 24 hours before backfilling. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. If any leaks appear in the manholes, the inside joints shall be caulked with lead wool to the satisfaction of the Engineer.

Where holes must be cut in precast sections to accommodate pipes, this cutting shall be done prior to setting them in place. All holes in sections shall be thoroughly filled with mortar and finished smooth and flush with adjoining surfaces.

All holes in sections for handling shall be thoroughly plugged with mortar.

4B-7 MANHOLES

Drain manholes 4 ft. in diameter, as shown in Appendix B-2, shall be used on pipe sizes 24-in. and smaller. Manholes on larger drains shall be approved by the Engineer.

The bottom slab of manholes shall be built on a 6-in. screened gravel base. Manhole bases shall be precast concrete or cast-in-place Manhole cast-in-place bases for drains shall be constructed to provide a slab for support of the concrete black masonry wall or reinforced concrete walls.

Drain manhole inverts shall be constructed of concrete fill sloped to drain between flow-through pipes. No invert is required for pipes entering drain manholes or structures from catch basins.

An inlet manhole shall be identical to a drain manhole except that the clear opening shall be 24" and a 24" square frame and grate, in conformance with Section 4B-10, shall be provided.

When approved by the Engineer, the use of an extended grate, as Shown in Appendixes B-4 and B-5, shall be permitted. The grate shall consist of an Irving Deck and frame having a width of 21.5 inches and a length of 60 inches, as manufactured by Lyons Iron Works, or approved equal. The trough base shall be constructed of 8 inches of concrete cast-in-place at a minimum depth of 1 ft. and having a slope of 1 in. per foot. The trough walls shall be constructed of 8-inch masonry blocks.

4B-8 CATCH BASINS

Catch basins shall be 4 ft. in diameter, as shown in Appendix B-3. Sumps shall be 3 ft. unless otherwise approved by the Engineer.

The bottom slab of catch basins shall be built on a 6-in screened gravel base. Catch basin bases shall be precast concrete or cast-in-place. Catch basin cast-in-place bases shall be constructed to provide a slab for support of the concrete block masonry wall or reinforced concrete walls.

4B-9 MANHOLE FRAMES AND COVERS

Manhole frames and covers shall provide a 30" diameter clear opening. The cover shall have the letter "D" or the word "DRAIN" in 3" letters cast into the top surface. Covers shall have two lift holes, 180 degrees apart, on the perimeter.

The castings shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended. Contact surfaces of covers and frame seats shall be machined at the foundry, before shipment to prevent rocking of covers in any orientation.

All castings shall be thoroughly cleaned and subject to a careful hammer inspection.

Castings shall be at least Class 30 conforming to the ASTM Standard Specification for Gray Iron Castings, Designation A48.

Before being shipped from the foundry, castings shall be sandblasted and given two coats of coal-tar-pitch varnish, applied in a satisfactory manner so as to make a smooth coating, tough, tenacious, and not brittle or with any tendency to scale off.

4B-10 CATCH BASIN FRAMES AND GRATES

Catch basin frames and grates shall be 24" square, with either a cast iron frame and galvanized steel grate, conforming to Type B on Standard Sheet No. 3 of the New Hampshire Department of Transportation Standard Specifications or a 24" square cast iron frame and cast iron grate, conforming to Alternate 1 Grate for CB-B and DI-B on Standard Sheet No. 3-A of the New Hampshire Department of Transportation Standard Specifications.

Catch Basin Grate and Frame Type "F" and alternate Type "F" conforming to State of New Hampshire Department of Transportation's Standard Specifications may be used on steep roadways where high capacity is needed. The Type "F" Grate is shown on Plate 8 of Standard No. 3 and the Type "F" alternate grate is shown on Plate 7 of Standard No. 3-B.

When approved by the Engineer, the use of an extended grate, as shown in Appendixes B-4, shall be permitted. The grate shall consist of an Irving Deck and frame having a width of 21.5 inches and a length of 60 inches, as manufactured by Lyons Iron Works, or approved equal. The trough base shall be constructed of 8 inches of concrete cast-in-place at a minimum depth of 1 ft. and having a slope of 1 in. per foot The trough walls shall be constructed of 8-inch masonry blocks.

4B-ll SETTING MANHOLE FRAMES AND COVERS

Manhole frames and covers shall be set in conformance with Section 3I-6.

4B-12 SETTING CATCH BASIN FRAMES AND GRATES

Catch basin frames and grates shall be set in conformance with Section 3I-6.

4B-l3 CLEANING DRAINAGE STRUCTURES

All manholes and catch basins shall be thoroughly cleaned prior to final inspection, by the removal of all accumulations of silt, debris, and foreign matter of any kind.

SECTION 4C

HEADWALLS

4C-l SCOPE OF WORK

This section shall include construction of headwalls as shown in Appendix B-6, and as shown on the contract drawings.

4C-2 CAST-IN-PLACE CONCRETE

Concrete used shall conform to the requirements for Class A concrete in Section 520 of the New Hampshire Department of Transportation Standard specifications.

4C-3 MASONRY

All masonry shall be made with mortar composed of one part Portland Cement to two parts sand to which a small amount of hydrated lime, not to exceed 10 lbs. to each bag of cement, may be added.

Sand shall be washed, cleaned, screened, sharp, and well graded, with no grain larger than a No. 4 sieve opening. It shall be free from vegetable matter, loam, organic or other material of such nature and quantity as to render it unsatisfactory.

No so-called "dry-masonry" without mortar will be permitted

SECTION 4D

RIPRAP

4D-l SCOPE OF WORK

Rip-rap will be placed where shown on the plans to the extent indicated on the plans.

4D-2 RIPRAP

The stone used for riprap shall be sound, free from structural defects and shall consist of a durable field or quarry stone roughly as rectangular block. At least 50% of the stones shall weigh in excess of 150 lbs. each, and the remainder shall weigh from 50-150 lbs. each. One dimension of each exposed stone shall not be less than 12 inches. Rip-rap shall be bedded in bank run gravel. The stones shall be placed by mechanical equipment immediately after preparation of the gravel bed, with the stones laid so that the 12-inch dimension is perpendicular to the prepared bed. Stones shall be placed so that the weight of the

stone is carried by the underlying material and not by the adjacent stones, with the larger stones placed at the bottom of the slope. Spaces between stones shall be filled with spalls of suitable size to construct a solid, stable slope, free from large voids which might not protect the earth slopes against erosion.

DIVISION 5 - STREETS

SECTION 5A PAVEMENT

5A-l SCOPE OF WORK

This section includes removal and replacement of pavements over trenches excavated for installation of drains, sewers, and appurtenances as well as pavement for new streets.

5A-2 CUTTING AND REMOVING PAVEMENT

The Contractor shall remove only as much existing pavement as necessary to do the work. Where excavations are to be made in paved surfaces, he shall out the pavement ahead of the excavation by sawing before breaking the pavement within the excavated limits for removal. All pavement shall be cut by sawing. Sawing and removal shall be done so as to produce clean, uniform, vertical edges without damage to the remaining pavement. Pavement removed shall not be mixed with other excavated material, but shall be disposed of away from the site of the work before the remainder of the excavation is made.

5A-3 GRAVEL SUB-BASE

3ackfilling of trenches in streets shall be as specified in Section 2B. The top of the trench shall be backfilled with 1 ft. of bank-run gravel as specified in Section 2D. The gravel shall be thoroughly compacted to the satisfaction of the Engineer.

5A-4 TEMPORARY PAVEMENT

Where directed by the Engineer and immediately after backfilling, place temporary bituminous pavement, consisting of Type B or Type F Hot Bituminous Pavement, 2-in thick, in accordance with Section 401 of the most recent Standard Specifications for Road and Bridge Construction of the Department of Transportation of the State of New Hampshire, and all amendments thereto. This temporary pavement shall be repaired as necessary to maintain the surface of the pavement until replaced by the permanent pavement. If points of settlement or holes appear in the temporary pavement, the Contractor shall repair the same within three days of notification by the Engineer or City Authority. When directed

by the Engineer, the Contractor shall remove the temporary pavement and regrade the sub-base for installation of permanent pavement.

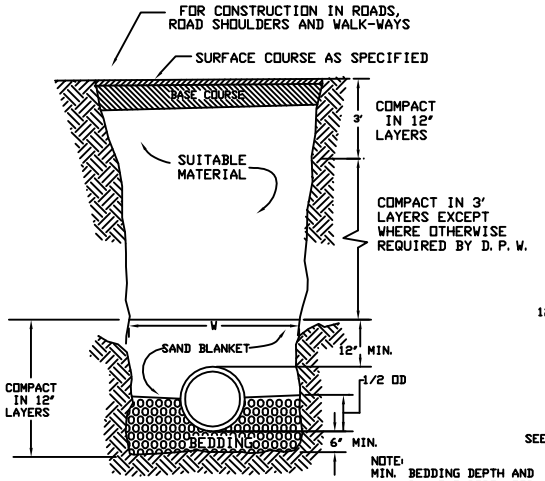
5A-5 3-IN BITUMINOUS CONCRETE PAVEMENT

No permanent pavement shall be placed over a backfilled trench within 60 days after compaction of the backfilling unless permitted to do so in writing by the Engineer. Repaving may be delayed for a longer time if the Engineer so directs.

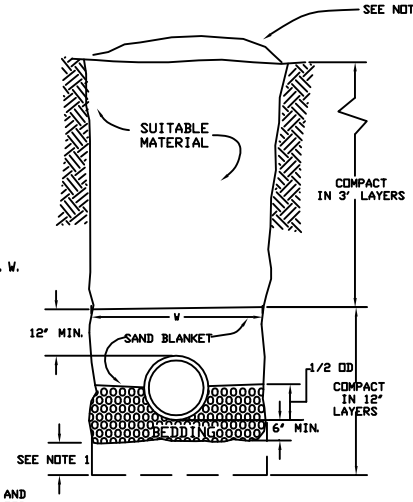
Permanent pavement shall consist of a 2 inch base course of Type B and a 1-inch wearing course of Type F Hot Bituminous Pavement meeting in every respect Section 401 of the most recent Standard Specifications for Road and Bridge Construction of the Department of Transportation of the State of New Hampshire. The edges of the existing pavement shall be trimmed back to a reasonably smooth line subject to the approval of the Engineer. Immediately prior to laying the binder and wearing courses, the trimmed edges shall be stable and unyielding, free of loose or broken pieces and all edges shall be thoroughly broomed and coated with an approved asphalt tack coat. Broom the entire binder course prior to placing wearing course.

The wearing course shall be rolled until thoroughly compacted by a roller weighing approximately 10 tons, but not heavy enough to damage the existing adjacent pavement.

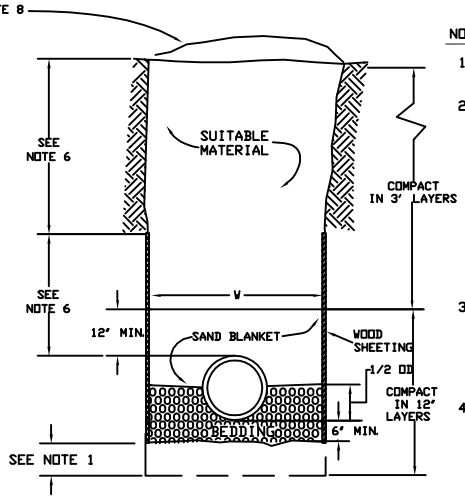
APPENDIX A
STANDARD SEWER DETAILS



LEDGE CONSTRUCTION



EARTH CONSTRUCTION



EARTH CONSTRUCTION WITH SHEETING

NOTES:

1- ORDERED EXCAVATION OF UNSUITABLE MATERIAL BELOW GRADE. REFILL WITH BEDDING MATERIAL. SEE ALSO NOTE 7.

2- BEDDING. SCREENED GRAVEL AND/OR CRUSHED STONE FREE FROM CLAY, LOAM, ORGANIC MATTER AND MEETING ASTM C33 STONE SIZE NO. 67.

100% PASSING	1 INCH SCREEN
90-100% PASSING	3/4 INCH SCREEN
20-55% PASSING	3/8 INCH SCREEN
0-10% PASSING	#4 SIEVE
0-5% PASSING	#8 SIEVE

WHERE ORDERED BY THE ENGINEER TO STABILIZE THE TRENCH BASE, GRADED SCREENED GRAVEL OR CRUSHED STONE 1/2 INCH TO 1-1/2 INCHES SHALL BE USED.

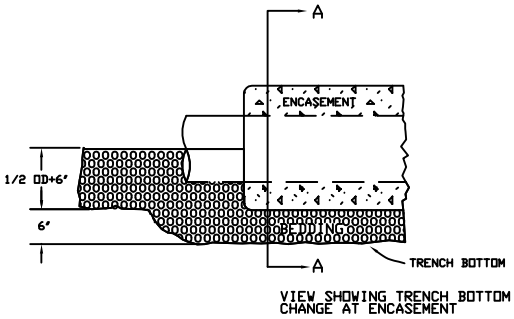
3- SAND BLANKET. CLEAN SAND FREE FROM ORGANIC MATTER, SO GRADED THAT 90-100% PASSES A 1/2 INCH SIEVE AND NOT MORE THAN 15% WILL PASS #200 SIEVE. BLANKET MAY BE OMMITED FOR CAST-IRON, DUCTILE IRON AND REINFORCED CONCRETE PIPE PROVIDED HOWEVER, THAT NO STONE LARGER THAN 2" IS IN CONTACT WITH THE PIPE.

4- SUITABLE, MATERIAL. IN ROADS, ROAD SHOULDERS, WALK-WAYS AND TRAVELED WAYS, SUITABLE MATERIAL FOR TRENCH BACKFILL SHALL BE THE NATURAL MATERIAL EXCAVATED DURING THE COURSE OF CONSTRUCTION, BUT SHALL EXCLUDE DEBRIS, PIECES OF PAVEMENT, ORGANIC MATTER, TOP SOIL, ALL WET OR SOFT MUCK, PEAT OR CLAY, ALL EXCAVATED LEDGE MATERIAL, AND ALL ROCKS OVER SIX INCHES IN LARGEST DIMENSION, OR ANY MATERIAL WHICH, AS DETERMINED BY THE ENGINEER, WILL NOT PROVIDE SUFFICIENT SUPPORT OR MAINTAIN THE COMPLETED CONSTRUCTION IN A STABLE CONDITION.

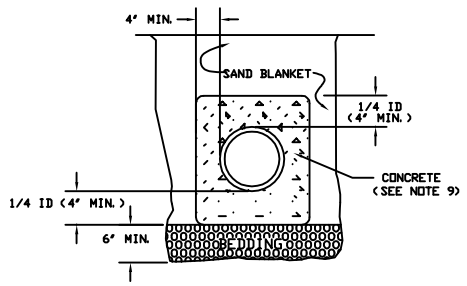
IN CROSS-COUNTRY CONSTRUCTION, SUITABLE MATERIAL SHALL BE AS DESCRIBED ABOVE, EXCEPT THAT THE ENGINEER MAY PERMIT THE USE OF TOP SOIL, LOAM, MUCK OR PEAT. IF THE ENGINEER IS SATISIFIED THAT THE COMPLETED CONSTRUCTION WILL BE ENTIRELY STABLE AND PROVIDED THAT EASY ACCESS TO THE SEWER FOR MAINTENANCE AND POSSIBLY RECONSTRUCTION, WHEN NECESSARY WILL BE PRESERVED.

5- BASE COURSE. IF ORDERED BY THE ENGINEER, SHALL MEET THE REQUIREMENTS OF DIVISION 300 OF THE LATEST EDITION OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION OF THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION.

6- WOOD SHEETING, IF REQUIRED. WHERE SHEETING IS PLACED ALONGSIDE THE PIPE AND EXTENDS BELOW MID-DIAMETER, IT SHALL BE CUT OFF AND LEFT IN PLACE TO AN ELEVATION NOT LESS THAN ONE FOOT ABOVE THE TOP OF THE PIPE. WHERE SHEETING IS ORDERED BY THE ENGINEER TO BE LEFT IN PLACE, IT SHALL BE CUT OFF AT LEAST THREE FEET BELOW FINISHED GRADE, BUT NOT LESS THAN ONE FOOT ABOVE THE TOP OF THE PIPE.



VIEW SHOWING TRENCH BOTTOM CHANGE AT ENCASEMENT



CONCRETE FULL ENCASEMENT (SEE NOTE 10) SECTION A-A

NOTES CONTINUED

7- W = MAXIMUM ALLOWABLE TRENCH WIDTH TO A PLANE 12 INCHES ABOVE THE PIPE. FOR PIPES 15 INCHES NOMINAL DIAMETER OR LESS, W SHALL BE NO MORE THAN 36 INCHES; FOR PIPES GREATER THAN 15 INCHES NOMINAL DIAMETER, W SHALL BE 24 INCHES PLUS PIPE O.D. W SHALL ALSO BE THE PAYMENT WIDTH FOR LEDGE EXCAVATION AND FOR ORDERED EXCAVATION BELOW GRADE.

8- FOR CROSS COUNTRY CONSTRUCTION, BACKFILL OR FILL SHALL BE MOUNDED TO A HEIGHT OF SIX INCHES ABOVE THE ORIGINAL GROUND SURFACE.

9- CONCRETE FOR ENCASEMENT SHALL CONFORM TO THE REQUIREMENTS FOR CLASS A (3000#) CONCRETE OF THE NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS AS FOLLOWS:

-CEMENT: 6.5 BAGS PER CUBIC YARD
-WATER: 5.23 GALLONS PER BAG CEMENT
-MAXIMUM SIZE OF AGGREGATE: 1 INCH

10- IF FULL ENCASEMENT IS UTILIZED, DEPTH OF CONCRETE BELOW PIPE SHALL BE 1/4 I.D. (4" MIN.) BLOCK SUPPORT SHALL BE SOLID BLOCKS.

11- WATER LINES SHALL BE SEPARATED FROM SANITARY SEWER LINES BY A TEN FOOT HORIZONTAL DISTANCE.

12- WHENEVER SANITARY SEWER MUST CROSS WATER MAINS, THE SEWER SHALL BE CONSTRUCTED AS FOLLOWS:

(A) SEWER PIPE SHALL BE CLASS 52 DUCTILE IRON FOR A MINIMUM DISTANCE OF 9 FEET EACH SIDE OF THE CROSSING.

(B) JOINTS SHALL BE MECHANICAL TYPE WATER PRESSURE RATED WITH ZERO LEAKAGE WHEN TESTED AT 25 POUNDS PER SQUARE INCH FOR GRAVITY SEWERS AND 1-1/2 TIMES WORKING PRESSURE FOR FORCE MAINS AND JOINTS SHALL NOT BE LOCATED WITHIN 9 FEET OF THE CROSSING.

(C) VERTICAL SEPARATION OF THE SANITARY SEWER AND WATER MAIN SHALL NOT BE LESS THAN 18".

NO.	DATE	REVISION

STANDARD TRENCH SECTION

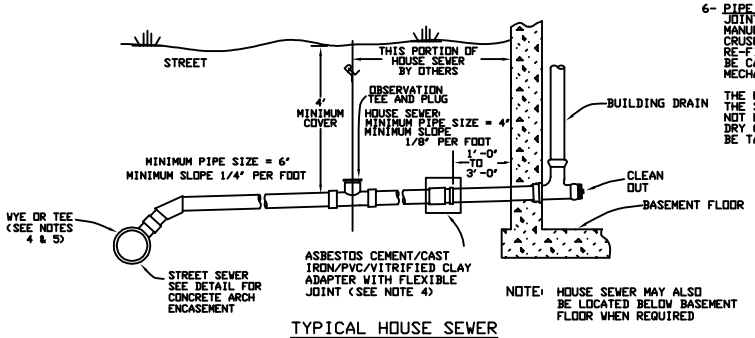
NOTE: SEPARATE CONSTRUCTION SPECIFICATIONS ARE ATTACHED OR INCLUDED IN THE CONTRACT DOCUMENTS. THESE STANDARD MANHOLE DRAWINGS ARE NOT COMPLETE WITHOUT THESE SPECIFICATIONS.

STANDARD DETAILS

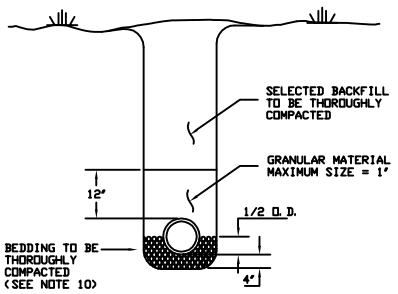
SCALE: AS NOTED DATE: APRIL 1992

CITY ENGINEER'S OFFICE

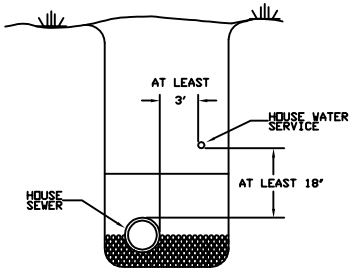
REVISION	DESIGNED	DRAFTED
		A.J.K.



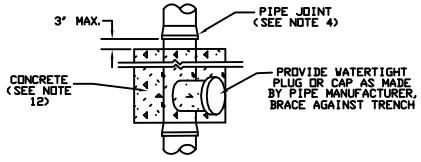
TYPICAL HOUSE SEWER

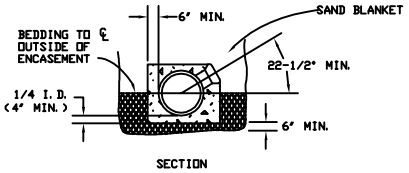


TRENCH CROSS-SECTION

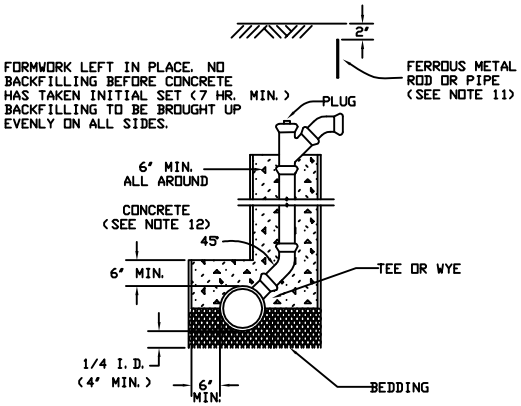


WATER AND SEWER IN SAME TRENCH
(SEE NOTE 9)





CONCRETE FULL ENCASEMENT



CHIMNEY
(SEE NOTE 13)

HOUSE SEWER DETAILS

NOTES CONTINUED

6- PIPE INSTALLATION. THE PIPE SHALL BE HANDLED, PLACED, AND JOINTED IN ACCORDANCE WITH INSTALLATION GUIDES OF THE APPROPRIATE MANUFACTURER. IT SHALL BE CAREFULLY BEDDED ON A 4-INCH LAYER OF CRUSHED STONE AND/OR GRAVEL AS SPECIFIED IN NOTE 10. BEDDING AND RE-FILL FOR A DEPTH OF 12 INCHES ABOVE THE TOP OF THE PIPE SHALL BE CAREFULLY AND THOROUGHLY TAMPED BY HAND OR WITH APPROPRIATE MECHANICAL DEVICES.

THE PIPE SHALL BE LAID AT A CONTINUOUS AND CONSTANT GRADE FROM THE STREET SEWER CONNECTION TO THE HOUSE FOUNDATION AT A GRADE OF NOT LESS THAN 1/8 INCH PER FOOT. PIPE JOINTS MUST BE MADE UNDER DRY CONDITIONS. IF WATER IS PRESENT, ALL NECESSARY STEPS SHALL BE TAKEN TO DEWATER THE TRENCH.

NOTES:

1- MINIMUM SIZE PIPE FOR HOUSE SERVICE SHALL BE FOUR INCHES.

2- PIPE AND JOINT MATERIALS:
- A. VITRIFIED CLAY PIPE
  - 1- PIPE AND FITTINGS SHALL BE EXTRA STRENGTH CLAY PIPE CONFORMING TO THE REQUIREMENTS OF ASTM C-700.
  - 2- JOINTS SHALL BE MADE WITH OIL RESISTANT GASKETS IN ACCORDANCE WITH ASTM C-425 TYPE III. MANUFACTURERS INSTRUCTIONS FOR INSTALLATION SHALL BE FOLLOWED.
- B. ASBESTOS-CEMENT-NON-PRESSURE SEWER PIPE
  - 1- PIPE AND FITTINGS SHALL CONFORM TO ASTM TENTATIVE SPECIFICATIONS C-644 TYPE II.
  - 2- JOINTS SHALL BE OF THE SLEEVE-COUPLING TYPE CONFORMING TO ASTM SPECIFICATIONS C-644 TYPE II. COMPRESSION RINGS SHALL BE OF OIL RESISTANT RUBBER TYPE OR ELASTOMERIC MATERIAL AND SHALL CONFORM TO ASTM SPECIFICATIONS D-1869. MANUFACTURERS SPECIFICATIONS SHALL BE FOLLOWED.
- C. CAST-IRON PIPE FITTINGS AND JOINTS
  - 1- CAST-IRON PIPE AND FITTINGS SHALL CONFORM TO THE FOLLOWING STANDARDS OF THE AMERICAN NATIONAL STANDARDS INSTITUTE:
    - A21.1 THICKNESS DESIGN OF CAST-IRON PIPE
    - A21.4 CEMENT MORTAR LINING FOR CAST-IRON PIPE AND FITTINGS
    - A21.6 CAST-IRON PIPE CENTRIFUGALLY CAST IN METAL MOLDS FOR WATER OR OTHER LIQUIDS
    - A21.8 CAST-IRON PIPE CENTRIFUGALLY CAST IN SAND-LINED MOLDS FOR WATER OR OTHER LIQUIDS.
    - A21.10 CAST-IRON FITTINGS, 2 INCHES THROUGH 48 INCHES FOR WATER AND OTHER LIQUIDS.
  - 2- JOINTS SHALL BE OF THE MECHANICAL OR PUSH-ON TYPE. JOINTS AND GASKETS SHALL CONFORM TO:
    - A21.11 RUBBER GASKET JOINTS FOR CAST-IRON PRESSURE PIPE AND FITTINGS.
- D. DUCTILE-IRON PIPE, FITTINGS AND JOINTS
  - 1- DUCTILE-IRON PIPE AND FITTINGS SHALL CONFORM TO THE FOLLOWING STANDARDS OF THE UNITED STATES OF AMERICA STANDARDS INSTITUTE:
    - A21.50 THICKNESS DESIGN OF DUCTILE-IRON PIPE AND WITH ASTM A-536 DUCTILE-IRON CASTINGS.
    - A21.51 DUCTILE-IRON PIPE, CENTRIFUGALLY CAST IN METAL MOLDS OR SAND-LINED MOLDS FOR WATER OR OTHER LIQUIDS.
  - 2- JOINTS SHALL BE AS SPECIFIED IN NOTE C.2 (CAST-IRON PIPE FITTINGS AND JOINTS) ABOVE.
- E. PVC (POLYVINYL CHLORIDE) PIPE
  - 1- APPROVED FOR DOMESTIC SEWAGE SERVICE.
  - 2- PVC PIPE AND FITTINGS SHALL BE TYPE SDR-35 HAVING BELL AND SPIGOT JOINTS CONFORMING TO ASTM SPECIFICATION D-3034.
  - 3- JOINTS SHALL BE BELL AND SPIGOT TYPE HAVING ELASTOMERIC GASKETS CONFORMING TO ASTM SPECIFICATION D-3212.

3- DAMAGED PIPE SHALL BE REJECTED AND REMOVED FROM THE JOB SITE.

4- JOINTS SHALL BE DEPENDENT UPON A NEOPRENE OR ELASTOMERIC GASKET FOR WATER-TIGHTNESS. ALL JOINTS SHALL BE PROPERLY MATCHED WITH THE PIPE MATERIALS USED. WHERE DIFFERING MATERIALS ARE TO BE CONNECTED, AS AT THE STREET SEWER WYE OR AT THE FOUNDATION WALL, APPROPRIATE MANUFATURED ADAPTERS SHALL BE USED.

5- TEES OR WYES. WHERE A TEE OR WYE IS NOT AVAILABLE IN THE EXISTING STREET SEWER, AN APPROPRIATE CONNECTION SHALL BE MADE, FOLLOWING MANUFACTURERS INSTRUCTIONS USING A BOLTED, CLAMPED, OR EPOXY-CEMENTED SADDLE TAPPED INTO A SMOOTHLY DRILLED OR SAWN OPENING IN THE SEWER. THE PRACTICE OF BREAKING AN OPENING WITH A SLEDGE HAMMER, STUFFING CLOTH OR OTHER SUCH MATERIAL AROUND THE JOINT, OR APPLYING MORTAR TO HOLD THE CONNECTION, AND OTHER SIMILAR CRUDE PRACTICES OR INEPT OR HASTY IMPROVISATIONS WILL NOT BE PERMITTED. THE CONNECTION SHALL BE CONCRETE ENCASED AS SHOWN IN THE DETAIL UP TO AND INCLUDING 15" DIAMETER. THESE INSTRUCTIONS DO NOT APPLY TO INSTALLATIONS WHERE TEES OR WYES ARE USED.

NOTES CONTINUED

7- TESTING. THE COMPLETED HOUSE SEWER SHALL BE SUBJECTED TO A LEAKAGE TEST IN ANY OF THE FOLLOWING MANNERS (PRIOR TO BACK-FILLING):
- A. AN OBSERVATION TEE SHALL BE INSTALLED AS SHOWN AND, WHEN READY FOR TESTING, AN INFLATABLE BLADDER OR PLUG SHALL BE INSERTED JUST UPSTREAM FROM THE OPENING IN THE TEE AFTER INFLATION, WATER SHALL BE INTRODUCED INTO THE SYSTEM ABOVE THE PLUG TO A HEIGHT OF 5 FEET ABOVE THE LEVEL OF THE PLUG.
- B. THE PIPE SHALL BE LEFT EXPOSED AND LIBERALLY HOSED WITH WATER TO SIMULATE AS NEARLY AS POSSIBLE, WET TRENCH CONDITIONS OR, IF THE TRENCH IS WET, THE GROUND WATER SHALL BE PERMITTED TO RISE IN THE TRENCH OVER THE PIPE. INSPECTIONS FOR LEAKS SHALL RISE IN THE TRENCH OVER THE PIPE. INSPECTIONS FOR LEAKS SHALL BE MADE THROUGH THE CLEANOUT WITH A FLASLIGHT.
- C. DRY FLUORESCENT DYE SHALL BE SPRINKLED INTO THE TRENCH OVER THE PIPE. IF THE TRENCH IS DRY, THE PIPE SHALL BE LIBERALLY HOSED WITH WATER, OR IF THE TRENCH IS, GROUND WATER SHALL BE PERMITTED TO RISE IN THE TRENCH OVER THE PIPE. OBSERVATION FOR LEAKS SHALL BE MADE IN THE FIRST DOWNSTREAM MANHOLE.

LEAKAGE OBSERVED IN ANY OF THE ABOVE ALTERNATE TESTS SHALL BE CAUSE FOR NON-ACCEPTANCE AND THE PIPE SHALL BE DUG-UP IF NECESSARY AND RE-LAID SO AS TO ASSURE WATER-TIGHTNESS.

8- ILLEGAL CONNECTION. NOTHING BUT SANITARY WASTE FLOW FROM HOUSE TOILETS, SINKS, LAUNDRY, ETC., SHALL BE PERMITTED. ROOF LEADERS, FOOTING DRAINS OR SUMP PUMPS, OR ANY OTHER SIMILAR CONNECTION CARRYING RAIN WATER, DRAINAGE, OR GROUND WATER, SHALL NOT BE PERMITTED.

9- HOUSE WATER SERVICE SHOULD NOT BE LAID IN THE SAME TRENCH AS THE SEWER SERVICE, BUT WHEN NECESSARY SHALL BE PLACED ABOVE AND TO ONE SIDE OF THE HOUSE SEWER AS SHOWN.

10- BEDDING: SCREENED GRAVEL AND/OR CRUSHED STONE FREE FROM CLAY, LOAM, ORGANIC MATERIAL AND MEETING ASTM C-33 STONE SIZE 67.

100% PASSING 1 INCH SCREEN	90-100% PASSING 3/4 INCH SCREEN
20-55% PASSING 3/8 INCH SCREEN	0-10% PASSING #4 SIEVE
0-5% PASSING #8 SIEVE	

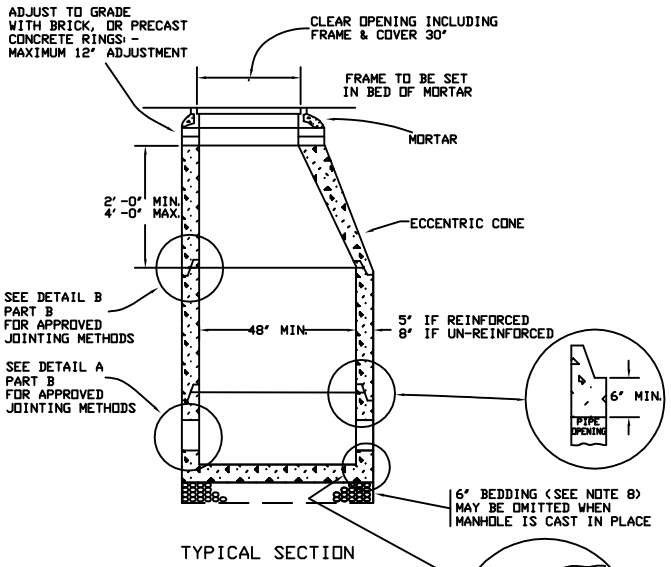
WHERE ORDERED BY THE ENGINEER TO STABILIZE THE BASE, SCREENED GRAVEL OR CRUSHED STONE 1/2 INCH TO 1-1/2 INCH SHALL BE USED.

11- LOCATION. THE LOCATION OF THE TEE OR WYE SHALL BE RECORDED AND FILED IN THE MUNICIPAL RECORDS. IN ADDITION, A FERROUS METAL ROD OR PIPE SHALL BE PLACED OVER THE TEE OR WYE AS DESCRIBED IN THE TYPICAL 'CHIMNEY' DETAIL, TO AID IN LOCATING THE BURIED PIPE WITH A DIP NEEDLE OR PIPE-FINDER.

12- CONCRETE. CONCRETE SHALL CONFORM TO THE REQUIREMENTS FOR CLASS A (3000#) CONCRETE OF THE NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS AS FOLLOWS:

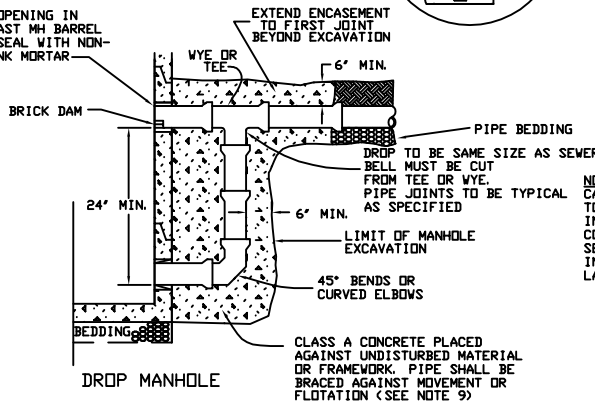
CEMENT: 6.5 BAGS PER CUBIC YARD
WATER: 5.23 GALLONS PER BAG CEEMENT
MAXIMUM SIZE OF AGGREGATE: 1 INCH

13- CHIMNEY: IF VERTICAL DROP INTO SEWER IS GREATER THAN 4 FEET, A CHIMNEY SHALL BE CONSTRUCTED FOR THE HOUSE CONNECTION.



TYPICAL SECTION

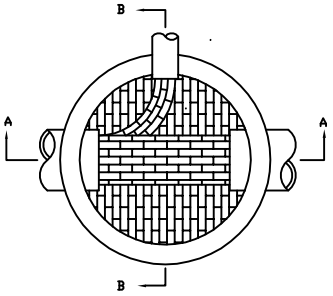
NOTE:
DIMENSIONS AND CONSTRUCTION OF DROP-MANHOLE TO BE SIMILAR TO TYPICAL MANHOLE EXCEPT AS SHOWN



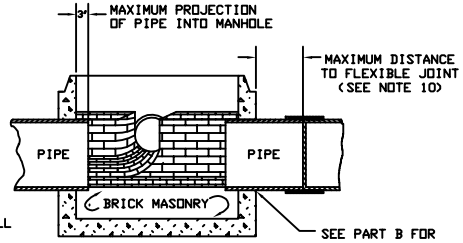
DROP MANHOLE

TOP OF SHELF SHALL BE 1" ABOVE CROWN OF HIGHEST PIPE

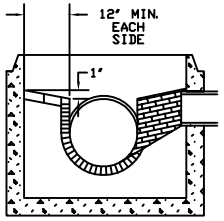
NOTE:
CARE SHALL BE TAKEN TO INSURE THAT THE BRICK INVERT IS A SMOOTH CONTINUATION OF THE SEWER INVERT. INVERT BRICKS SHALL BE LAID ON EDGE,



PLAN



SECTION A-A



NOTE:
INVERT AND SHELF TO BE PLACED AFTER LEAKAGE TEST.

SECTION B-B

NOTES:

1- ALL MANHOLE COMPONENT PARTS SHALL HAVE ADEQUATE SPACE, STRENGTH AND LEAKPROOF QUALITIES CONSIDERED NECESSARY FOR THE INTENDED SERVICE REQUIREMENTS AND CONFIGURATIONS, AND SHALL BE AS SHOWN ON THE DRAWING. MANHOLES MAY BE AN ASSEMBLY OF PRECAST SECTIONS, WITH OR WITHOUT STEEL REINFORCEMENTS, WITH ADEQUATE JOINTING, OR CONCRETE CAST MONOLITHICALLY IN PLACE WITH OR WITHOUT REINFORCEMENT. IN ANY APPROVED MANHOLE, THE COMPLETE STRUCTURE SHALL BE OF SUCH MATERIAL AND QUALITY AS TO WITHSTAND LOADS OF 8 TONS (H-20 LOADING) WITHOUT FAILURE AND PREVENT LEAKAGE IN EXCESS OF ONE GALLON PER DAY PER VERTICAL FOOT OF MANHOLE, CONTINUOUSLY FOR THE LIFE OF OF THE STRUCTURE. A PERIOD GENERALLY IN EXCESS OF 25 YEARS IS TO BE UNDERSTOOD IN BOTH CASES.

2- BARRELS AND CONE SECTIONS SHALL BE PRECAST REINFORCED OR NON-REINFORCED CONCRETE, OR POURED IN PLACE REINFORCED OR NON-REINFORCED CONCRETE.

3- PRECAST CONCRETE BARREL SECTIONS, CONES AND BASES SHALL CONFORM TO ASTM C478.

4- BASE SECTIONS SHALL BE MONOLITHIC TO A POINT 6" ABOVE THE CROWN OF THE INCOMING PIPE, AND SHALL BE PRE-CAST REINFORCED CONCRETE OR PRE-CAST NON-REINFORCED CONCRETE.

5- LEAKAGE TEST SHALL BE PERFORMED IN ACCORDANCE WITH THE SPECIFICATIONS.

6- INVERTS AND SHELVES: MANHOLES SHALL HAVE A BRICK PAVED SHELF AND INVERT, CONSTRUCTED TO CONFORM TO THE SIZE OF PIPE AND FLOW. AT CHANGES IN DIRECTION, THE INVERTS SHALL BE LAID OUT IN CURVES OF THE LONGEST RADIUS POSSIBLE TANGENT TO THE CENTER LINE OF THE SEWER PIPES. SHELVES SHALL BE CONSTRUCTED TO THE ELEVATION OF THE HIGHEST PIPE CROWN AND SLOPE TO DRAIN TOWARD THE FLOWING THROUGH CHANNEL. UNDERLAYMENT OF INVERT AND SHELF SHALL CONSIST OF BRICK MASONRY.

7- FRAMES AND COVERS: MANHOLE FRAMES AND COVERS SHALL BE OF HEAVY DUTY DESIGN AND PROVIDE A 30-INCH CLEAR OPENING. A 3-INCH (MINIMUM HEIGHT) LETTER 'S' FOR SEWERS OR 'D' FOR DRAINS SHALL BE PLAINLY CAST INTO THE CENTER OF EACH COVER.

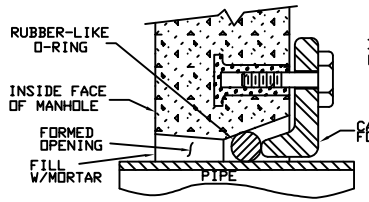
8- BEDDING: SCREENED GRAVEL AND/OR CRUSHED STONE FREE FROM CLAY, LOAM, ORGANIC MATTER AND MEETING ASTM C33
100% PASSING 1 INCH SCREEN
90-100% PASSING 3/4 INCH SCREEN
20-55% PASSING 3/8 INCH SCREEN
0-10% PASSING #4 SIEVE
0-5% PASSING #8 SIEVE
WHERE ORDERED BY THE ENGINEER TO STABILIZE THE BASE, SCREENED GRAVEL OR CRUSHED STONE 1/2 INCH TO 1-1/2 INCH SHALL BE USED.

9- CONCRETE FOR DROP SUPPORT SHALL CONFORM TO THE REQUIREMENT FOR CLASS A (3000#) CONCRETE OF THE NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS AS FOLLOWS:
CEMENT: 6.5 BAGS PER CUBIC YARD
WATER: 5.23 GALLONS PER BAG CEMENT
MAXIMUM SIZE OF AGGREGATE: 1 INCH

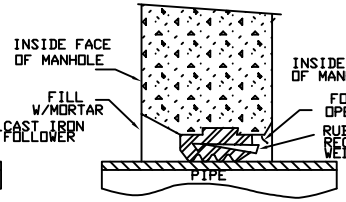
10- FLEXIBLE JOINT: A FLEXIBLE JOINT SHALL BE PROVIDED WITHIN THE FOLLOWING DISTANCES:
RCP & CI PIPE - ALL SIZES - 48"
AC & VC PIPE - UP THROUGH 12" DIA. - 18"
AC & VC PIPE - LARGER THAN 12" DIA. - 36"
DI PIPE - NO FLEXIBLE JOINT REQUIRED
PVC PIPE - UP THROUGH 15" DIA. - NO FLEXIBLE JOINT REQUIRED.

11- SHALLOW MANHOLE: IN LIEU OF A CONE SECTION, WHEN MANHOLE DEPTH IS LESS THAN 6 FEET, A REINFORCED CONCRETE SLAB COVER MAY BE USED HAVING AN ECCENTRIC ENTRANCE OPENING AND CAPABLE OF SUPPORTING H-20 LOADS.

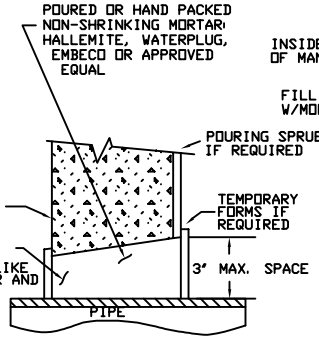
STANDARD MANHOLE - PART A



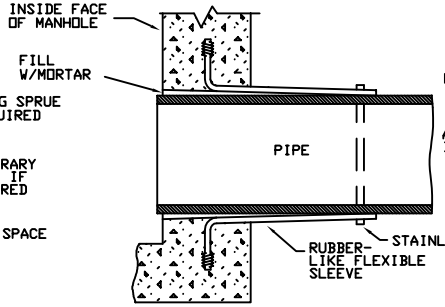
RES-SEAL
(OR EQUAL)



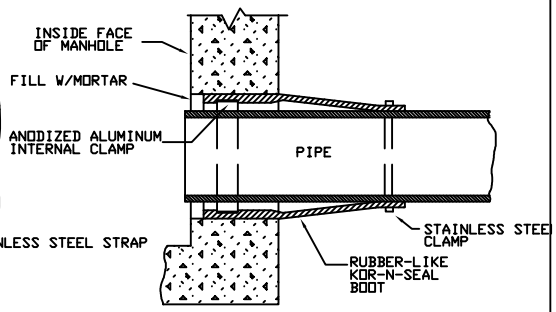
PRESS-WEDGE II
(OR EQUAL)



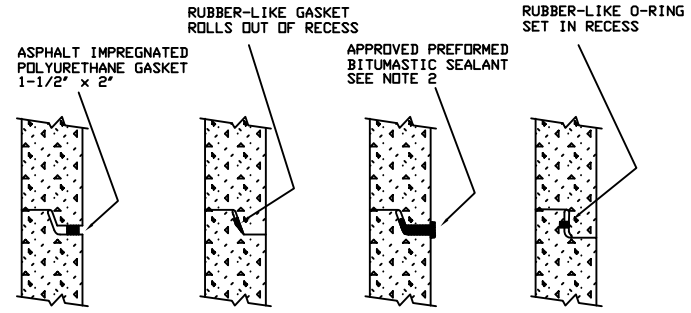
NON-SHRINKING MORTAR



LOCK-JOINT FLEXIBLE MANHOLE SLEEVE
(OR EQUAL)



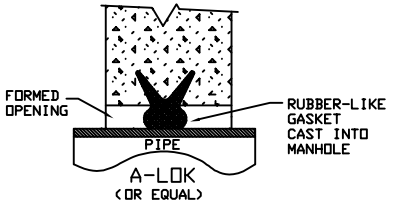
KOR-N-SEAL JOINT SLEEVE
(OR EQUAL)



POLYTITE (OR EQUAL) | ROLL-N-LOK (OR EQUAL) | BITUMASTIC | O-RING

NOTE: ALL GASKETS AND SEALANTS SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS WRITTEN INSTRUCTIONS

DETAIL - B



A-LOK
(OR EQUAL)

NOTE: ALL GASKETS, SEALANTS, MORTAR, ETC, SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS' WRITTEN INSTRUCTIONS

DETAIL - A

NOTES:

1- HORIZONTAL JOINTS BETWEEN SECTIONS OF PRECAST CONCRETE BARRELS SHALL BE OF AN OVERLAPPING TYPE, WHICH TYPE SHALL, IN GENERAL, DEPEND FOR WATERTIGHTNESS UPON ON ELASTOMERIC OR MASTIC-LIKE GASKET.

2- FOR BITUMASTIC TYPE JOINTS THE AMOUNT OF SEALANT SHALL BE SUFFICIENT TO FILL AT LEAST 75% OF THE JOINT CAVITY.

APPROVED BITUMASTIC SEALANTS:
RAM-NEK
KENT SEAL NO. 2

3- PIPE TO MANHOLE JOINTS SHALL BE AS FOLLOWS:

(A) ELASTOMERIC, RUBBER, SLEEVE WITH WATERTIGHT JOINTS AT THE MANHOLE OPENING AND PIPE SURFACES.

(B) JOINTS AT THE MANHOLE MAY BE CAST INTO WALL OR SECURED WITH STAINLESS STEEL CLAMPS, JOINTS AT THE PIPE SHALL BE SECURED WITH STAINLESS STEEL CLAMPS.

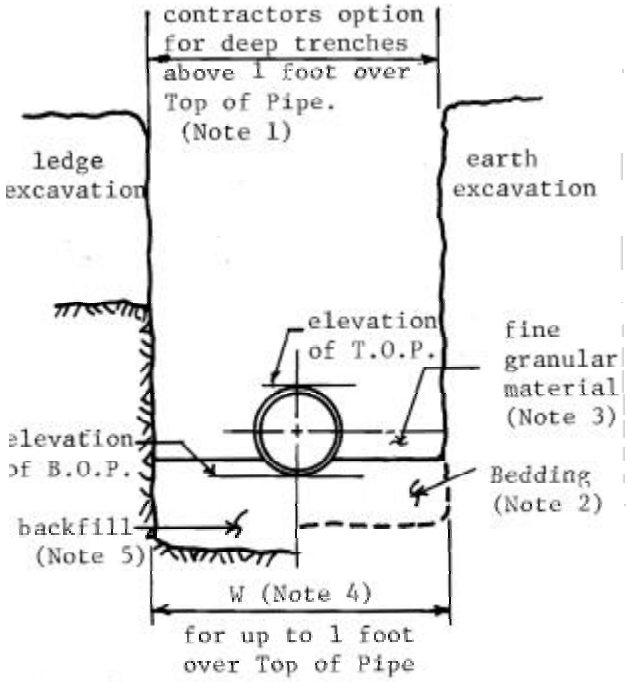
(C) ELASTOMERIC SEALING RING CAST IN THE MANHOLE OPENING WITH SEAL FORMED ON THE SURFACE OF THE PIPE BY COMPRESSION OF THE RING.

(D) NON-SHRINK GROUTED JOINTS WHERE WATERTIGHT BONDING TO THE MANHOLE AND PIPE CAN BE OBTAINED.

STANDARD MANHOLE - PART B

APPENDIX B

STANDARD DRAIN DETAILS



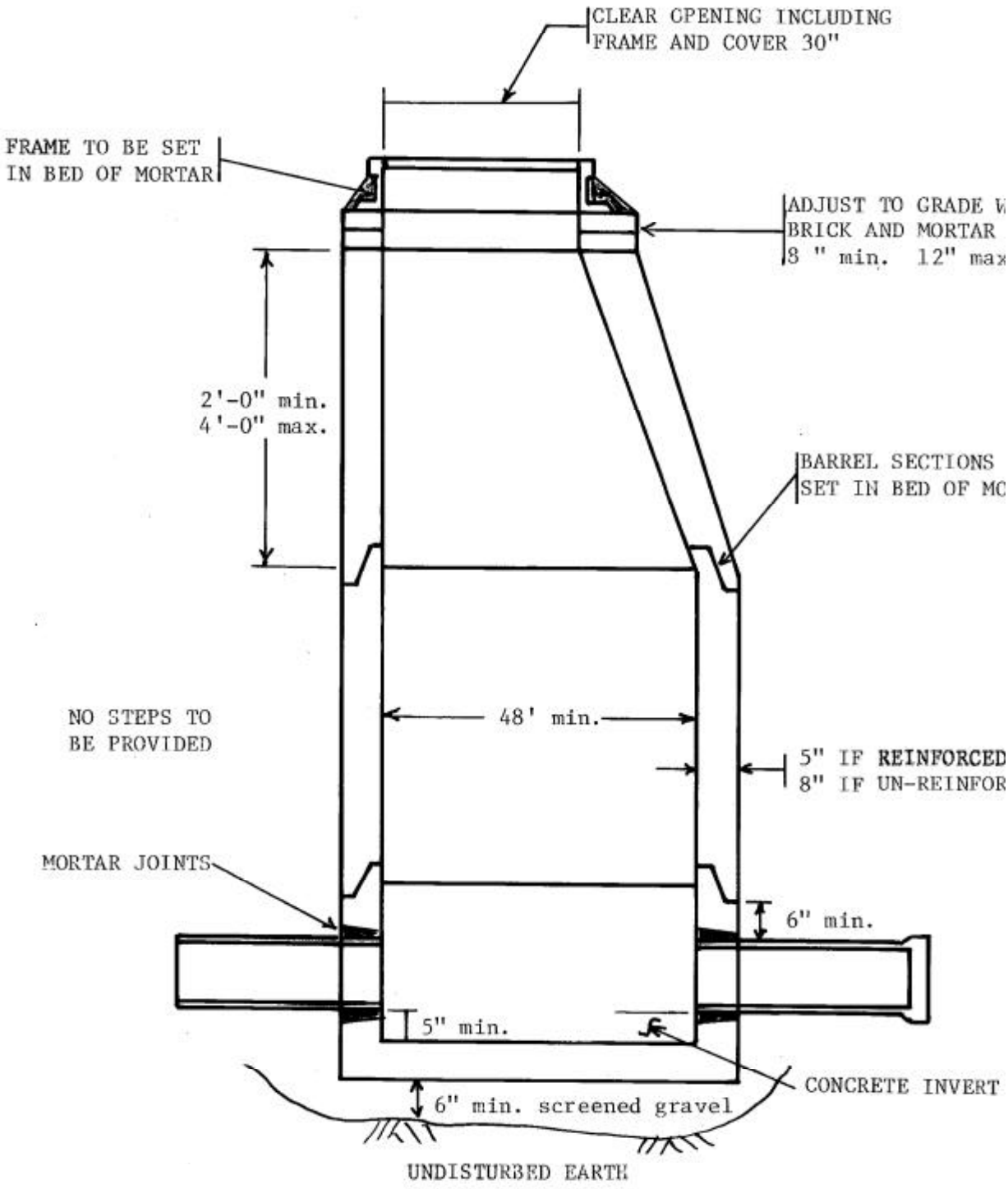
NOTE
For unsuitable excavation
see Note 6.

1. The width of trenches shall be held to a minimum consistent with the space required to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Trenches wider than 3 times the diameter of the pipe will not be permitted. If necessary shoring or sheeting shall be used to prevent overcutting at the level of the top of the pipe.
2. Bedding shall consist of carefully preparing and shaping a bed of fine granular material to fit the lower 15 percent of the external height of the pipe with a minimum of 4" under the bottom of the pipe. Recesses shall be excavated for the bells of the pipe.
3. Fine granular material shall be placed and compacted to mid-diameter.
4. Width limits shall be as follows:

Inside diameter	Total width
up to 12"	36"
12" to 24"	I.D. +24"
over 24"	2 x I.D.

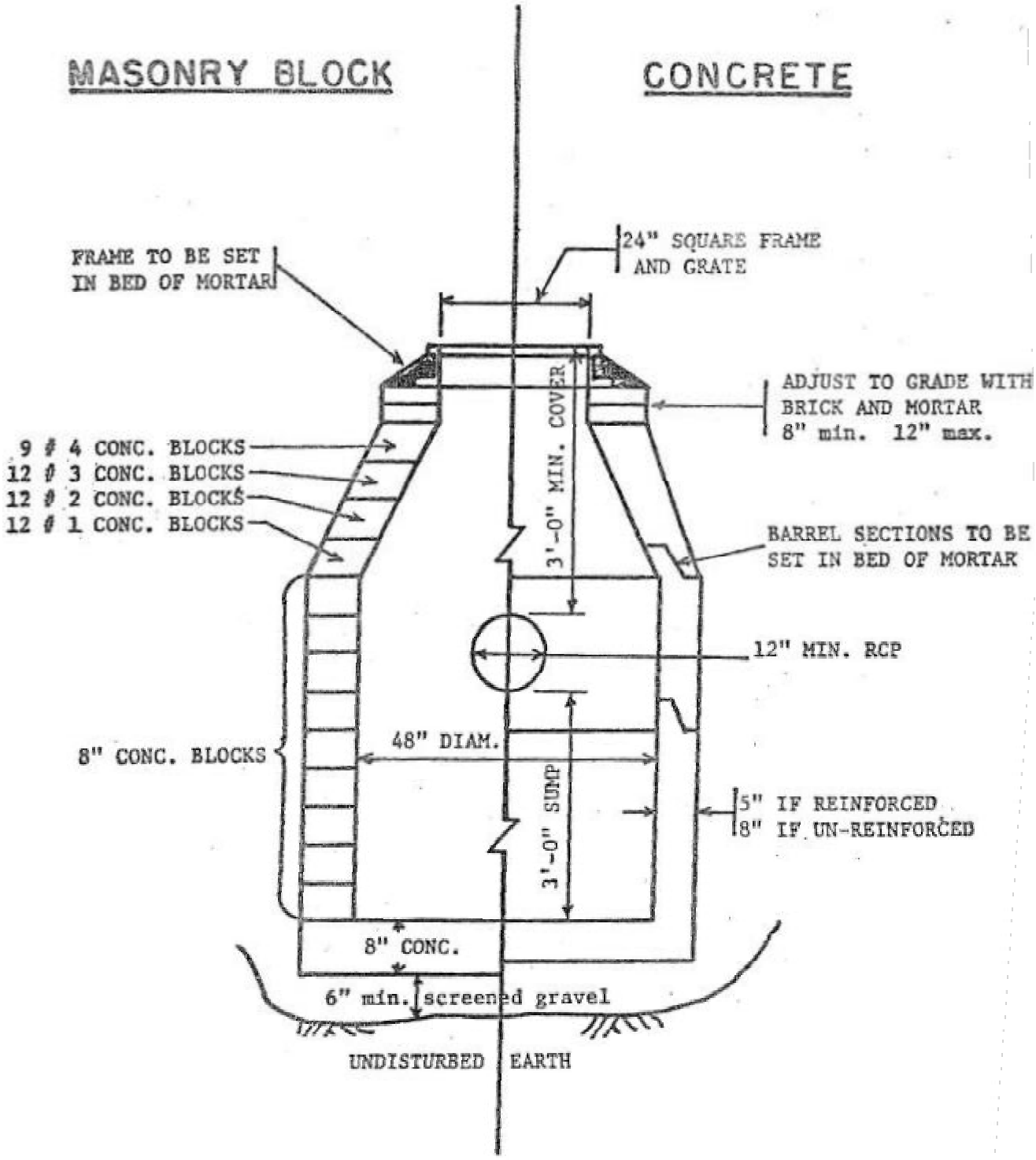
5. Granular backfill or other approved material shall be used to backfill the spaces left by the excavation of ledge. The material shall be uniformly compacted by the use of light construction equipment and shaped as indicated in Note 2 or 3 above with a minimum of 8" under the elevation of the bottom of the pipe.
6. UNSUITABLE EXCAVATION
   Where soft or other unsuitable material is encountered, all of such unsuitable material, for the depth and width ordered, shall be removed and backfilled with granular or other approved material and shaped as indicated in note 2 or 3 above.

TRENCH DETAILS FOR DRAINAGE PIPE



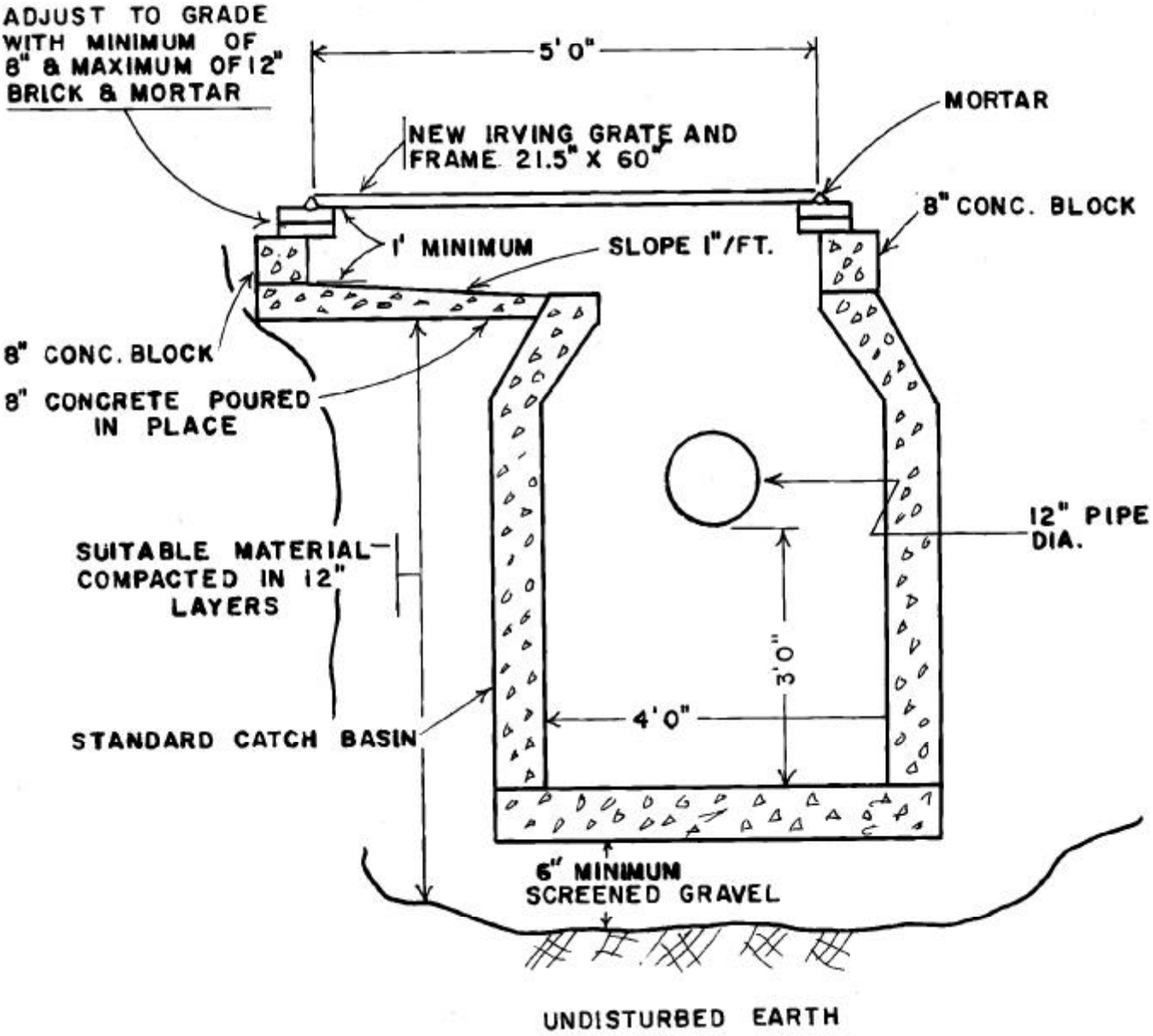
DRAIN MANHOLE

(NOT TO SCALE)



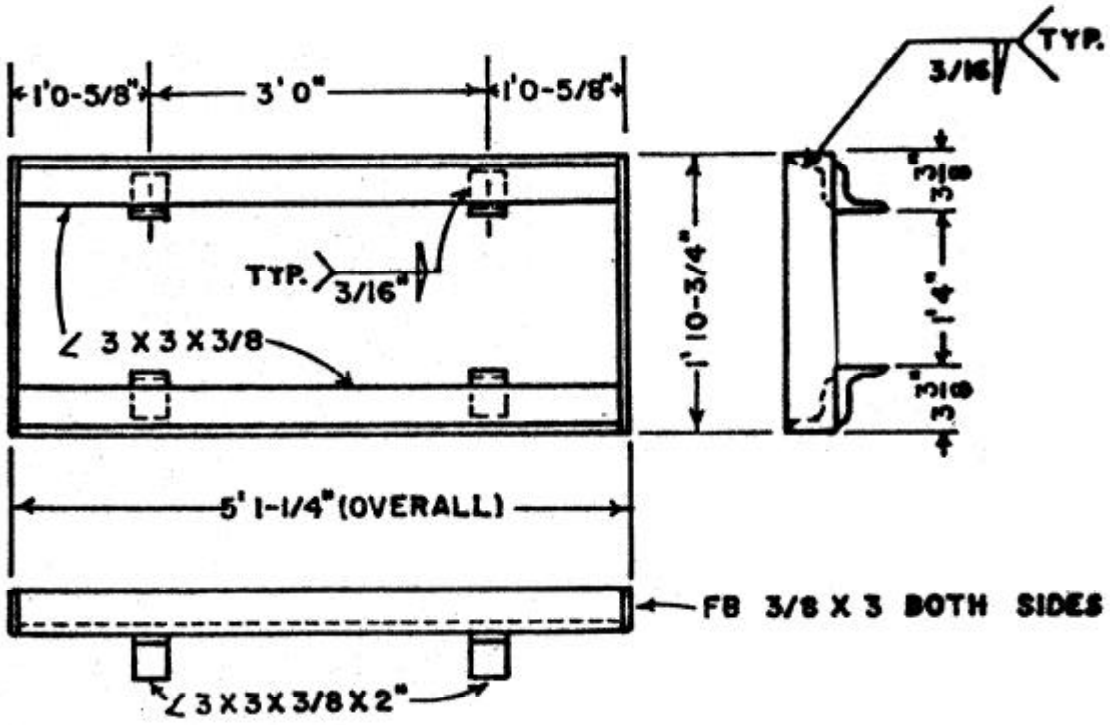
CATCH BASIN

(NOT TO SCALE)



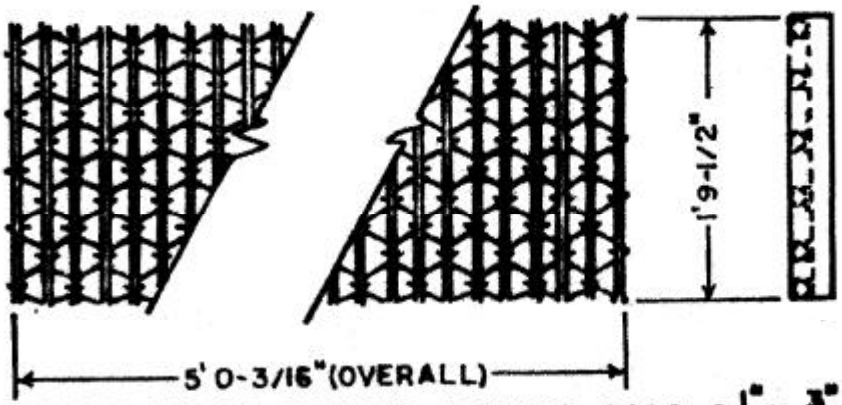
CATCH BASIN WITH EXTENDED IRVING GRATE

NOT TO SCALE



NOTE: BLAST CLEAN AND PRIME RED OXIDE.

FRAME

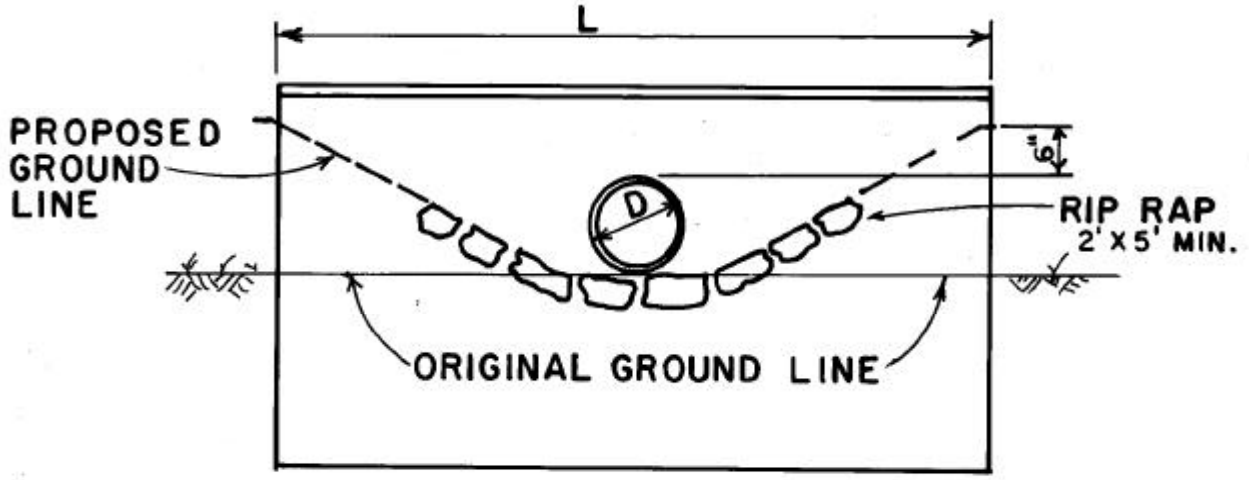


NOTE: TYPE HV GRATING. BEARING BARS $2\frac{1}{2}$" X $\frac{3}{16}$" @ $2\frac{1}{2}$" O.C.
RETICULINE BAR SIZE $1\frac{1}{2}$" X $\frac{3}{16}$". RIVETS @ 5" O.C.
PAINTED RED OXIDE.

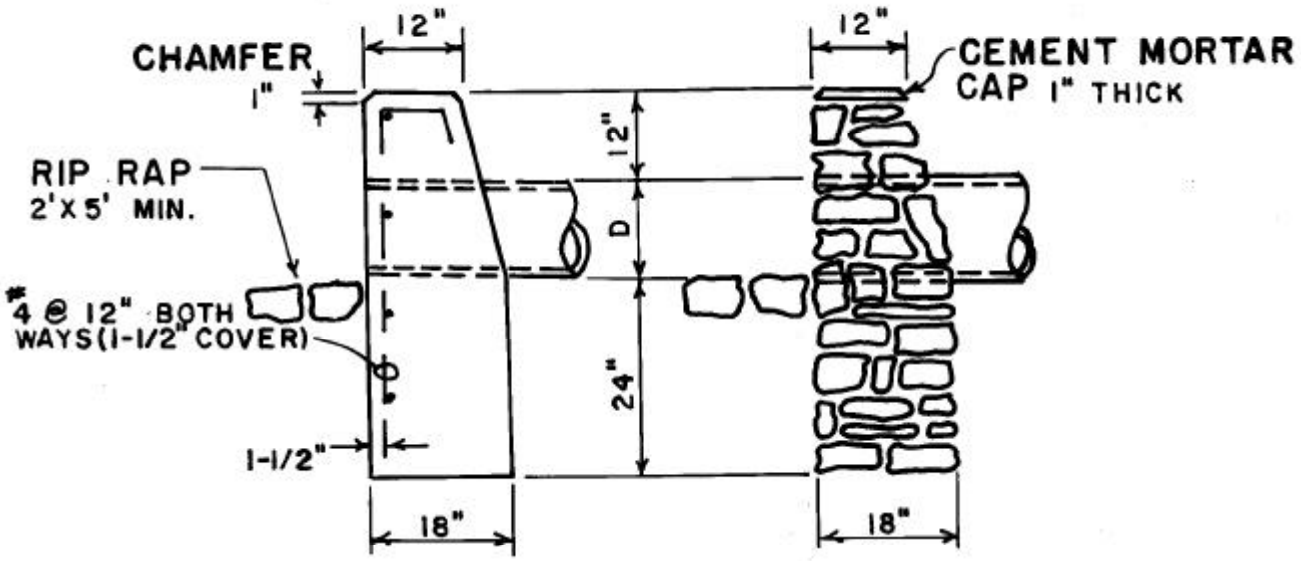
GRATE

EXTENDED IRVING GRATE

NOT TO SCALE



FRONT ELEVATION



SIDE ELEVATION

PIPE "D"	"L"
12"	7'-6"
15"	8'-9"
18"	10'-0"
21"	11'-6"
24"	12'-6"
30"	15'-0"

FIELD STONE MASONRY & CONCRETE HEADWALL

(NOT TO SCALE)

STANDARD SPECIFICATIONS

FOR

ROAD CONSTRUCTION

NASHUA, NEW HAMPSHIRE

BOARD OF PU8LIC WORKS

ADOPTED AND APPROVED JUNE 11,1986

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SECTION 100 GENERAL PROVISIONS

100.1 APPLICABILITY & AUTHORITY

1. These specifications govern all roadway construction within dedicated public ways and easements of subdivisions, and are issued under the authority given to the City Engineer and the Board of Public Works by Title 8, Chapter 5, Section 418; and by Title 6, Chapter 7, Sections 601-627 of the Nashua Revised Ordinances.

   If any conflict should arise between these specifications and Title 6, Chapter 11, the more stringent shall govern.

2. These specifications also apply to road work which is constructed by Public Works Department employees, by virtue of its adoption as a standard by the Board of Public Works.

3. When so stated in the contract, these specifications shall govern the work of private contractors doing work under contract to the City of Nashua, Board of Public Works.

4. These specifications shall govern the work of all private contractors doing work for developers, contractors, etc. in streets and easements which shall later be dedicated for acceptance by the City of Nashua.

5. This specification shall not supersede the Standard Specification for Sewers and Drains, revised approved and adopted March 24, 1983.

6. Drainlayers and utilities desiring to work in accepted City Streets must first obtain a Street Opening Permit from the City of Nashua Street Department on Riverside Street.

100.2 DEFINITIONS

"Contract Drawings" shall be the construction drawings which have been approved by the City Engineer~, signed "approved" and on file in his office.

"Contractor" shall be the party doing the construction: either a private contractor or the Department of Public Works crews, as the case may be.

"Drain" - A pipe or conduit that carries storm water and surface water, street wash, and other wash waters, but excludes domestic waste water and industrial wastes; equivalent to a "storm drain" or "storm sewer" and including "culverts."

"Engineer" shall be understood to be the City Engineer, or his appointed representatives.

"Inspector" shall be understood to be an inspector of the Department of Public Works.

"Roadway" shall mean the entire R.O.W., and any cut or fill slopes which extend beyond the R.O.W.

"Select Materials" shall mean those base course materials, as specified in Section 300.

"Sewer" - A pipe or conduit that carries waste water from residences, commercial buildings, industrial plants, and institutions; equivalent to "Sanitary Sewer."

"Standard Specifications for Road and Bridge Construction, NHDPW & Highways" shall be the most recent available, including all revisions and addendums.

"Subgrade" shall mean the top surface of the road bed upon which select materials are placed.

100.3 QUALITY CONTROL

AUTHORITY AND DUTIES OF INSPECTORS

Inspectors shall be authorized to inspect all work done and materials furnished. Such inspection may extend to all or any part of the work, and to the preparation or manufacture of the materials to be used. In case of any dispute arising between the Contractor and the Inspector as to materials furnished or the manner of performing the work, the Inspector shall have the authority to reject material or suspend the work until the question at issue can be referred to and decided by the Engineer. The Inspector shall not be authorized to revoke, alter, enlarge, relax or release any requirements of these specifications nor to approve or accept any portion of the work, nor to issue instructions contrary to the Plans and specifications.

The Inspector shall in no case act as a foreman or perform other duties for the Contractor or interfere with the management of the work by the Contractor. Any advice which the Inspector may give the Contractor shall in no circumstances be construed as binding to the Engineer in any way.

INSPECTION OF THE WORK

The Contractor shall not start any road construction or lay or bury any pipes or casings or other appurtenances except in the presence of the Engineer or the Inspector. To this end, 48 hours notice shall be given the Engineer by the Contractor of the time and place he intends to do the work. Any work which is done without having given notice or is done contrary to the direction of the Engineer is considered unauthorized and will not be accepted. The Contractor shall remove and replace any unsatisfactory work.

100.4 SPECIAL CONTROLS

Erosion Control

The Contractor shall take due precautions to minimize the run-off of pollution substances such as silt, clay, fuels, oils, bitumens, calcium

chloride and any other polluting material harmful to humans, fish or other life into the waters of the State. Methods and materials conforming to section 645-Erosion Control, of the Standard Specifications for Road and Bridge Construction, NHDPW & Highways shall be used.

Dust Control

Dust control shall be provided when deemed necessary by the Engineer so as to prevent damage and nuisance to adjacent property owners and public streets. The means of dust control may include the use of water, calcium chloride or other approved methods.

Traffic Control

The contractor shall erect and maintain traffic control devices and employ flagmen or City of Nashua Police officers to direct traffic when directed to do so by the Engineer. The Manual on Uniform Traffic Control Devices for Streets and Highways Part IV is a part of these specifications.

Detours will only be allowed after obtaining approval from the City Engineer in consultation with the Police Department, Fire Department, Ambulance Service, and any other emergency or public agency which may be effected.

A request for a proposed detour shall be accompanied with a detailed plan showing the following;

1. Street to be closed

2. Location of construction signs

3. Location of flagmen

4. Dates and hours of the proposed detour

5. Method for notifying the public agencies affected

6. Method for notifying the general public

7 Method for notifying the effected abutters

When, in the opinion of the Engineer, public safety or convenience requires the services of the police r the Engineer may direct the Contractor to request the Nashua Police Department to assign officers to direct traffic within the location of work.

Nothing contained herein shall be construed as relieving the Contractor of any of his responsibilities for protection of persons and property.

Police are to be paid by the Contractor.

Use of Explosives

The storage, handling, transportation and use of explosives shall conform with all Federal, State, and local laws and regulations, including the rules and regulation5 of the Director of State Police and the provisions below.

The Contractor's attention is called to RSA 158:9-a (Supp.), which in part provides that licenses must be obtained from the Director of State Police in order (1) to use, purchase, or transport explosives, or (2) to store explosives.

When the use of explosives is necessary for the prosecution of the work, the Contractor shall exercise the utmost care not to endanger 1ife or property, including new work. The Contractor will be responsible for all damage resulting from the use of explosives.

All explosives shall be stored in a secure manner. All storage places shall be clearly marked. Explosives shall be stored in a magazine which shall be located in respect to buildings, railways, and highways in a manner as required by the Director of State Police.

The Contractor shall notify each public utility company having structures in proximity to the site of the work of his intention to use explosives. Such notice shall be given sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property from injury.

Explosives shall be used only during daylight hours, shall be handled only by competent workmen, and particular care shall be taken to insure that no unexploded charges remain in the work.

All persons within the danger zone of blasting operations shall be warned and no blasting shall be done until the zone has been cleared. Sufficient flagmen shall be stationed outside the danger zone to stop all approaching traffic during blasting operations.

100.5 SUITABILITY OF MATERIALS

All materials to be used shall be subject to inspection and approval or rejection by the Engineer, Any material rejected shall be immediately removed from the work site.

All manufactured materials shall be accompanied with a Certificate of Compliance. The Certificate of Compliance shall be given to the Engineer prior to using the material. The certificate shall show the following:

a. Date of certification
b. Description of material
c. Name of contractor or developer to whom the material is supplied
d. Name of project or development where material is to be used
e. Name of manufacturer
f. Name of supplier
g. The material meets the requirements of the Board of Public Works
h. Quantity of material covered by the certification
i. Date of manufacture, for precast concrete only)
j. Date delivered to project

k. Identification markings on the material
1. Signature and title of the person having legal authority to bind the originator of the certificate

A certificate may be submitted by either the manufacturer, the supplier, or the contractor.

A sample certificate of compliance is shown in Section 100.9.

Materials listed in the certification may be subject to random sampling and testing by the engineer. Certified materials which fail to meet specification requirements will not be accepted.

The following is a partial list of materials requiring certification: any other manufactured materials not listed shall also be furnished with a certificate:

- Clay Brick
- Bituminous Materials
- Castings: Grates, frames & covers
- Concrete: Blocks, bricks & precast sections.
- Culverts
- Fence
- Guard Rail
- Pipe: Drainage, sewer
- Steel: Reinforcing, mesh, structural
- Conduits: All types
- Precast concrete manhole sections sewer & drain
- Precast concrete catchbasins

100.6 PLANT INSPECTION

The Engineer may undertake the inspection of materials at the source.

In the event plant inspection is undertaken, the following conditions shall be met:

(a) The Engineer shall have cooperation and assistance of the Contractor and the producer with whom he has contracted for materials being furnished.

(b) If specified, the Contractor shall arrange for an approved building for the use of the inspector: such building to be located conveniently near the plant, independent of any building being used by the material producer, in which to house and use the equipment necessary to carry on the required tests.

(c) Adequate safety measures shall be provided and maintained.

100.7 SAMPLING AND TESTING OF MATERIALS

The cost of sampling and testing will be the responsibility of the contractor doing the work, In the case of a Licensed Drainlayer, the cost of sampling and testing will be billed through the Inspectors Fees Procedure. The contractor may elect to have materials sampled and tested by an independent testing laboratory of his choice, provided the laboratory meets with the approval of the Engineer; in which case, sampling shall be done in the presence of an Inspector and test results furnished to the Engineer. Sampling and testing frequency will be determined by the Engineer.

Previously approved material, later found to be unacceptable shall be considered as having never been approved, and shall be removed from the work site.

100.8 MATERIALS FOR WHICH NO SPECIFICATIONS HAS BEEN ADOPTED BY THE BOARD OF PUBLIC WORKS

In the event a material to be used is not specifically mentioned in these specifications, the acceptance and use of such material shall be subject to prior approval by the Engineer. The contractor or developer shall submit his request with documentation, test-results, and samples to the Engineer.

100.9 SAMPLE CERTIFICATE OF COMPLIANCE

O R G A N I Z A T I O N L E T T E R H E A D
(Manufacturer, Supplier, or Contractor)

C E R T I F I C A T E O F C O M P L I A N C E
--Manufactured or Fabricated Material--

Date_____20_____

WE HEREBY CERTIFY THAT_____
Description, Kind of Material, or Trade Name

Furnished to_____
Contractor (Prime or Sub)

For use on_____
Project Name

Used for Item No. _____ _____
Name of Item

Identified by_____

Manufactured by_____

Date of Manufacture (Precast concrete only)_____

Supplied by_____

Date of Delivery _____

MEETS THE REQUIREMENTS OF THE PERTINENT PROJECT PLANS, SPECIAL PROVISIONS AND SPECIFICATIONS OF THE NASHUA, N.H. BOARD OF PUBLIC

WORKS IN ALL RESPECTS. PROCESSING, PRODUCT TESTING AND INSPECTION CONTROL OF RAW MATERIALS ARE IN CONFORMANCE WITH ALL APPLICABLE SPECIFICATIONS. DRAWINGS AND/OR STANDARDS OF ALL ARTICLES FURNISHED.

_____
Manufacturer, Supplier or Contractor

Signed by_____
(Officer of Organization)

Title_____

(For more than one item, list each Item No., Item Name,
Manufacturer, and/or Supplier)

SECTION 200 - EARTH WORK

200.1 CLEARING AND GRUBBING

SCOPE OF WORK

Clearing and grubbing shall be carried out where necessary. The Contractor will be allowed to remove only the trees and brush that are absolutely necessary for his construction operations, The Contractor shall be expected to save as many trees as is possible. The removal of all brush and trees, including their stumps necessary for construction purposes, shall be done in such a manner to present a neat appearance at the end of the work. No stumps, roots, brush or timber shall be buried within the limit5 of the roadway, or within the limits of any lot to be dedicated for public purposes, or within the limits of any public easement.

CLEARING

Clearing shall consist of felling, cutting and the satisfactory disposal of trees, brush and other vegetation down-timber, and rubbish.

If land owners desire the timber or small trees, the Contractor shall cut and neatly pile it in 4-ft. length for removal by the land owner; otherwise the Contractor shall dispose of it by hauling away. No burning will be permitted unless the Contractor obtains the permission of the City of Nashua Fire Chief beforehand.

GRUBBING

Grubbing shall be carried out where trees have been felled, and shall consist of the removal and disposal of stumps, including all roots larger than 3-in in diameter to a depth of 18-in. below ground surface and within a 3 ft. radius of the trunk. Stumps within the limits of the roadway shall be completely removed.

200.2 EXCAVATION AND EMBANKMENT FOR ROADWAYS

Earth excavation shall be considered all excavation not included as rock excavation. The removal of bituminous pavements shall be considered as earth excavation. Rock Excavation shall consist of all solid rock which requires for its removal drilling and blasting. It shall also consist of boulders and parts of masonry structures when found to measure 2 cubic yards or more. The removal of concrete pavements shall be considered as rock excavation.

Embankment material shall be either excavated material from the work site or borrow material from other sources. In either case, the material will subject to the approval of the Engineer. Embankment material shall be free of organic material loam, humus peat, muck, stumps, roots, sod, or any other material not suitable for foundation material regardless of moisture content.

Where excavation to designed elevations results in a subgrade or slope of unsuitable material, the contractor will be required to remove the unsuitable material as directed by Engineer. The backfilling will be done with approved materials and compacted to the design subgrade or slope.

Over-excavated subgrade in rock shall be backfilled to design subgrade with porous material, such as sand, gravel, or broken rock. Non-porous materials will not be acceptable.

Rock fragments in fills shall be placed in layers of such thickness as the Engineer may direct, and in no case in excess of 4 feet. The lifts shall be worked in such a manner as to close the voids with spalls and fines. When sufficient spalls or fines are not available to close the voids, earth shall be used to make a tight surface prior to placing the next lift.

200.3 PLACING EARTH FOR ROADWAYS

Earth shall be place in layers the full width of the roadway, generally parallel to the finished grade. The layers shall not exceed 12 inches of loose depth unless otherwise directed. Each layer shall be spread to a uniform thickness and compacted to the required density prior to placing the next layer. Continuous grading or shaping shall be carried out concurrently with the compactive effort to insure uniform density throughout each layer of material.

Embankments shall be graded at all times to insure the run-off of water. Any saturation of non-porous material due to the Contractor's selected method of operation will occasion the suspension of additional work on the area until rectification by drying, removing and replacing, or draining has restored the fill to a stable condition, at the contractor's expense.

200.4 WINTER CONSTRUCTION METHODS

No embankments shall be constructed on frozen earth materials. Each layer of material placed shall be compacted to the required density before it freezes. All frozen material shall be removed from the top of embankments prior to placing additional material. The frozen lumps of earth removed shall be placed outside of the limits of an assumed l-l/2 to 1 slope from the break in the shoulder and inside the designed or ordered slope line. If the above: specified conditions cannot be met, earthwork operations shall be suspended.

200.5 EMBANKMENT FOUNDATION

Where the existing ground is 3 feet or less below-subgrade, the top 6 inches within the limits of the roadbed shall be compacted to the same density as that required of the first-layer of material to be placed over it.

200.6 DENSITY REOUIREMENTS AND TESTS

Earth materials used to construct embankments shall be compacted to at least 95 percent of maximum density. The maximum density determination will be made as specified in AASHTO T99. (Standard Proctor Test.) The in place~density determination;will be made by AASHTO Tl91 (Sand cone method), AASHTO T204 (Drive Cylinder Method), or by AASHTO T238 and T239. (Nuclear Method.) The contractor shall obtain whatever equipment is necessary to achieve the specified density. Manipulation of tills, silts, and clays or any combination thereof, (including aeration where necessary} will be required to produce a stable fill of the required density. Water shall be evenly applied to granular materials, as required, to produce a fill of the required density.

200.7 TEST STRIP PROCEDURE

Those materials which cannot be tested for maximum density in accordance with AASHTO T99 shall be tested by the test strip procedure. At the beginning of the compaction operation, the maximum density shall be determined by compacting a short control section or "test strip" at a suitable moisture content until no further increase in density can be obtained. The remainder of the material placed shall be compacted to a density not less than 95% of the maximum strip test density. Densities shall be obtained by the nuclear method. A new test strip will be required when there is a significant change in the gradation of the material being placed. Compacting of the "test strip' shall be done with an approved vibratory roller or compactor producing a dynamic force of at least 27,000 pounds,

200.8 FINE GRADING

200.81 Description of work

This work shall consist of the final grading of all base course materials, the final grading of subgrade prior to placing base course materials, the grading of all slopes whether in or out of the right-of-way, and the final grading of all easements.

The surface of each course of material, including the subgrade, shall be fine graded to conform to the typical section of the plans prior to placing the succeeding course.

The contractor shall set, or provide for the setting of, grade stakes spaced sufficiently to afford facility for checking the surface of each layer. The stakes shall be marked in such a manner that the Inspector can readily determine the corresponding location and grade, as shown on the approved plans.

This work, also, includes the grading of sidewalk base course materials, loamed areas, driveway aprons, ditches, and any other areas shown to be constructed to a specified grade.

200.82 Inspection of the Work

The contractor shall notify the Engineer when he has completed the fine grading for each (layer) of base course material, including subgrade. The Engineer may take whatever measurements or tests he feels are necessary to verify the quality of the completed work.

The placing of the succeeding course shall not begin until the Engineer has had the opportunity to complete his measurements or tests. Whether or not the Engineer elects to take any measurements or tests will not relieve the contractor from constructing the project in accordance with the approved plans.

Grade stakes shall not be removed until the Engineer or Inspector has had the opportunity to complete his measurements or tests.

SECTION 300 - BASE COURSE MATERIALS

BASE COURSE MATERIALS

300.1 DESCRIPTION OF WORK

This section contains the requirements for materials to be used as base course material for roads and sidewalks.

Where appropriate item numbers correspond to NHDPW&H Standard Specifications for Road and Bridge Construction. All the requirements of Division 300, Base Courses, of the NHDPW&H Standard Specification for Road and Bridge Construction shall apply, unless more stringent requirements are stated herein

300.2 REQUIRED GRADING

-PERCENT PASSING-

SIEVE SIZE	SAND*	GRAVEL*	CRUSHED GRAVEL		GRANULAR BACKFILL		CRUSHED STONE FINE GRADATION
					SAND	GRAVEL	
ITEM NO.	304.1	304.2	304.3		209	209.1	304.4
3"			over 5000cy 100	under 5000 cy	100	95-100	
2"			95-100				100
1-1/2"				100			85-100
1"			55-85				
3/4"							45-75
NO. 4	70-100	25-70	27-52	27-55	70-100	25-70	20-45
NO. 200**	0-12	0-12	0-12	0-12	0-15	0-15	0-15

* Max. Size Stone = 3/4 X thickness of the layer being placed

** Based on that portion passing the No. 4 Sieve

300.3 COMPACTION OF BASE COURSE MATERIALS

Compaction of sand, gravel, crushed gravel and crushed stone shall be done with an approved vibratory roller. Rolling and grading shall begin on the lower side and progress to the higher part of the course with lapped rollings parallel to the center line. Rolling and grading shall continue until the layer conforms to the required grade and cross section and the surface is smooth and uniform.

The contractor shall furnish and distribute water uniformly over the material during compaction, as required, to obtain optimum moisture.

The minimum density required shall be 95 percent of the maximum density, as determined by the test strip method (See Section 200.7).

Base courses shall not be placed on or above frozen material. If the density requirements are not fulfilled for any layer before the material freezes, no further material shall be placed upon that layer.

300.4 TYPICAL SUBDIVISION STREET

The standard subdivision street shal1 have base course materials conforming to one of the following alternates:

ALT. "A"	ALT. "B"	ALT. "C"
4" Crushed Gravel	4" Crushed Stone (Fine Gradation)	12" Crushed Stone (Fine Gradation)
12" Gravel	12" Gravel	

Appendix "A' "Typical cross section, Subdivision street.' is a part of this specification.

ALTERNATE "D" - SOILS-ENGINEER-DESIGNED ROADWAY CROSS SECTION

Prior to submitting street plans for preliminary subdivision approval, as required under Title 8, Chapter 5, Section 407 (12), the subdivider may propose another typical cross section by obtaining and submitting to the City Engineer the following:

1) A report from a soils engineer, registered in the state of New Hampshire, detailing his findings and recommendations, for a proposed alternate roadway cross section.

2) The soils engineers report shall contain his recommendations on the following points:

A) Adequacy of the proposed cross section for its intended use.
B) Thickness and gradation of base materials.
C) Thickness of pavement.
D) Location and type of underdrain.
E) Removal and backfill of unsuitable material.
F) Any other characteristics of the site that in his opinion need special construction techniques or materials, to maintain the integrity of the roadway.

3) The soils engineer's report should contain the results of any sampling and testing performed.

The street plans will be reviewed by the City Engineer and compared with the soils engineer's recommendations.

ADDITIONAL REQUIREMENTS

1. Additional depths of base course materials may be ordered by the Engineer during construction, when in his opinion they are required.

2. Whether or not a cross section design report is prepared, the developer's engineer shall propose roadway underdrain, where necessary, to control any groundwater within the R.O.W. Additional underdrain may be ordered by the City Engineer during construction when in his opinion it is required.

SECTION 40O - HOT BITUMINOUS PAVEMENTS

400.1 DESCRIPTION OF WORK

These specifications shall apply to new construction, overlay projects, and the patching of existing city streets.

400.2 MIXING AND BATCHING PLANTS

Material for hot bituminous pavement shall only be obtained from plants meeting the requirements of the NHDPW&Hwy. Written proof of meeting this requirement shall be furnished to the Engineer prior to beginning any paving operation.

At least three working days in advance of starting paving operations, the Engineer shall be notified and provided with the following information: name and location of plant, project or street where the mix is to be used, estimated tonnage, material (base, binder, or top), mix type and the time the first load is to leave the plant.

The above information is needed, should the Engineer elect to have the mix tested at the plant during batching. The cost of such inspection and testing will be the responsibility of the contractor. Generally, plant inspection will not be required for patching or paving operations involving less than 100 tons of mix.

The Engineer shall have access at any time to all parts of the plant for inspection of the conditions and operations of the plant, for confirmation of the adequacy of the equipment in use, for verification or proportions and character of materials, and for determination of temperatures being maintained in the preparation of the mixtures.

400.3 JOB - MIX FORMULA

A job-mix formula shall be designed for each type of pavement to be used. The job-mix formula shall be presented to the Engineer, for his approval at least one week prior to beginning paving operations, and also one week prior to requesting a change in the job-mix formula after a formula has once been approved. The job-mix formula shall be accompanied with all back-up information necessary to verify the suitability of the formula.

After the job-mix formula is approved by the Engineer, all mixtures furnished for the project shall conform thereto, within the following ranges of tolerances:

Passing No. 4 and larger sieves	±7%
Passing No. 4 to No. 80 sieves	±4%
Passing No. 200 sieves	±2%
Bitumen	±0.4%
Mix temp. at the-plant	±20 F.

400.4 TYPICAL SUBDIVISION STREET

The mix designs for hot bituminous pavement for streets in subdivisions shall conform to Table 2 - Composition of Mixtures Master Ranges, as shown on page 118 of the Standard Specifications for Road and Bridge Construction NHDPW&Highways.

The base course shall be Type B: 3/4".

The wearing course shall be Type F: 3/8",

The mix design for hot bituminous concrete sidewalks in subdivisions shall conform to Table 1 - Composition of Mixtures - Master Ranges, as shown on page 331 of the Standard Specifications for Road and Bridge Construction, NHDPW& Highways. Sidewalks shall be constructed in (2) 1" courses. Handicap ramps shall be constructed at street intersections.

Appendix "A" is a part of these specifications.

400.5 MIXING TEMPERATURE

The aggregate shall be dried and heated to a minimum temperature of 260°F. The bitumen shall be heated to a temperature between 250°F and 325°F.

The Engineer may adjust the job-mix formula temperature within the limits of 260°F. and 325°F, discharge temperature. Material with a temperature at discharge, outside the job-mix formula tolerance may be rejected.

400.6 PLACING HOT BITUMINOUS PAVEMENT

The Engineer shall have the authority to prevent the starting of a paving operation or to suspend a paving operation that has begun, when in his opinion a satisfactory final product cannot be produced.

Mixtures shall be placed only when the underlying surface is dry, frost free and the surface temperature and air temperature is above 40°F. No load shall be sent out so late in the day-that spreading and compacting cannot be completed during daylight. Wearing course shall not be placed after October 30th, unless specifically permitted in writing by the Engineer. Base course pavement shall not be placed until the Engineer has been given the opportunity to inspect the crushed gravel for conformance to the plans and specifications. Wearing course pavement shall not be placed until the Engineer has been given the opportunity to inspect the base course pavement for conformance to the plans and specifications.

400.7 MINIMUM TEMPERATURE

Any Bituminous Pavement delivered to the project having a temperature lower than 250° F shall not be used. The pavement shall be thoroughly compacted in accordance with 400.13 before the mix cools to 180°F.

400.8 TACK COAT

Any base course pavement which has been exposed for a considerable length of time, such as over the winter, or has a dusty surface, shall be uniformity covered by a tack coat of emulsified asphalt immediately prior to paving the next course.

Emulsified asphalt for tack coat shall be SS-1, SS-lh, CSS-l, or CSS-lh diluted one part water to one part emulsified asphalt. The tack coat shall be applied on only as much pavement as can be covered with asphalt-aggregate mixture in the same day. The rate of application shall be 0.05 to 0.15 gals/s.y., as directed by the Engineer.

A tack coat of emulsified asphalt shall be applied to the contact edge of all utility castings, the contact edge of existing pavement, and to the contact edge of any previously placed mat that, in the opinion of the Engineer, will result in a cold joint. A longitudinal or transverse joint left open overnight shall be considered a cold joint, and will require a tact coat prior to continuing with the paving operation.

400.9 PAVERS

All courses of roadway pavement, shall be spread and finished to the required thickness by self contained, self-propelled, spreading and finishing machines, (pavers). Pavers shall be provided with an adjustable, activated screed or strike-off assembly, and shall be capable of spreading the mixture with a finish that is smooth, true to the required cross section, uniform in density and texture, and free from hollows, tears, gouges, corrugations, and other irregularities. Any paver producing an unsatisfactory mat shall be removed from the project.

Automatic screed controls will not be required, although they are allowed

400.10 HANDWORK

When paving small areas, or patches, not accessible with a self-propelled paver, care shall be taken to create a surface texture similar to the machine work. Surface material shall be spread by lutes.

400.11 LEVELING COURSE

In the event the base course has been allowed to deteriorate a leveling course shall be placed, with a paver, to a minimum depth as specified by the Engineer. Any utility castings previously set to grade shall be raised to allow for the additional pavement.

Leveling course pavement shall conform to Table 1 on Page 144 of the Standard Specification for Road and Bridge Construction, NHDPW&Hwys.

400.12 ADJUSTING UTILITY CASTINGS

The castings shall not be raised to finish grade until the base course of pavement has been placed. If the finish course is not scheduled to be placed soon, then a ring of hot bituminous pavement shall be placed around each casting which is likely to be struck by a vehicle or plow. The ring of material shall extend out from the edge of the casting a minimum of 2 feet and shall be finished to a feathered edge. The ring shall be removed prior to placing the finish course of pavement.

The void resulting from the raising of utility castings shall be filled with either Class A concrete or crushed gravel, in either case the last 2 inches shall be hot bituminous pavement. A tack coat shall be placed uniformly over the cured concrete prior to placing the hot bituminous pavement.

400.13 COMPACTION

Compaction of base course pavement shall be done with a minimum of one static steel - wheeled roller weighing at least 8 tons, followed by the use of a pneumatic - tired roller. One vibratory roller may be substituted for the steel wheeled and pneumatic rollers on base courses. Compaction of finish course pavement shall be done with a minimum of one static, steel-wheeled roller weighting at least 8 tons, followed by the use of a pneumatic-tired roller. A vibratory roller is not allowed on finish pavement. Each course shall be compacted to a minimum density of 95% of laboratory specimens, made the AASHTO T245 method in the proportions of the job-mix formula.

The wearing course shall be rolled with steel-wheeled roller until all roller marks are eliminated.

Additional rollers may be required on large projects, to obtain the desired pavement density.

400.14 TRANSVERSE JOINTS

Previously layed material shall be removed to provide a vertical butt joint of required thickness.

400.15 DELIVERY SLIPS

All loads of hot bituminous pavement shall be accompanied with a delivery slip, one copy to be retained by the engineer for his records. The slip shall have the following information:

a) Source of material
b) Type of material
c) Tons of material
d) Date
e) Plant inspectors initials (when appropriate)

SECTION 500 - SLOPE GRANITE CURB

500.1 DESCRIPTION OF WORK

This item consists of furnishing and installing slope granite curbing and shall conform to the following:

500.2 MATERIAL

Curbing shall be of hard and durable granite, light gray in color, and free from seams which impair its structural integrity. Variations characteristic of the formation are permitted.

Dimensions shall conform to the following:

Top - wire sawed to approximate true plane and shall be three (3) to nine (9) inches wide.

Front or exposed face - shall be smooth quarry split to an approximate true plane. Dimension of face shall be twelve (12) inches plus or minus one (1) inch. Face shall have no projections or depressions greater than one 11) inch, under a two foot straight edge.

Back or Concealed Face - shall be approximately parallel to the front or exposed face.

Length of Stone - minimum length shall be two (2) feet.

Ends of Stone - shall be square with the plane of the face and so finished that, when the stones are set, no space more than one inch shall show in the joint for the full width of the face.

500.3 CONSTRUCTION

Curb shall be set to the line and grade required by the City Engineer, on an approved foundation, on a one to one (1:1) slope and shall project seven (7) inches vertically above the finished shoulder grade or pavement, unless otherwise directed.

Slope granite curb when used on a radius of twenty (20) feet or less, shall be cut with radial joints.

Joints between curbstones shall be carefully filled with mortar for a depth of three (3) inches from the face. They shall be neatly jointed on the face, and all excess mortar shall be satisfactorily cleaned from the curbstone face.

Cement mortar shall be composed of equal parts of cement and sand with sufficient water to form a workable mixture.

Curbing shall be placed in a minimum of six (6) inches of compacted gravel. Curbing shal1 be set as specified and all spaces under curbstones carefully and thoroughly rammed so that the curbstone shall be completely supported throughout their entire length.

SECTION 600 - LOAMING & SEEDING

600.1 MATERIALS

Loam shall be fertile, natural soil, typical of the locality, free from large stones, roots, sticks clay, peat, weeds and sod and obtained from naturally well drained area. It shall not be excessively acid or alkaline nor contain toxic material harmful to plant growth.

Fertilizer shall be a complete commercial fertilizer, 10-10-10 grade. It shall be delivered to the site in the original unopened containers each showing the manufacturer's guaranteed analysis. Store fertilizer so that when used it shall be dry and free flowing.

Lime shall be ground limestone containing not less than 85 percent calcium and magnesium carbonates.

Seed shall be from the same or previous year's crop; each variety of seed shall have a percentage of germination not less than 90, a percentage of purity of not less than 85, and shall have not more than one percent weed content. The mixture shall consists of seed proportioned by weight as follows:

For grassplots and lawns:

Canadian Creeping Red Fescue	50%
Kentucky Bluegrass	20%
Red Top	15%
Domestic Rye Grass	15%

Seed shall be delivered in sealed containers bearing the dealer's guaranteed analysis.

600.2 APPLICATION

Loam shall be placed to a minimum depth of 4 inches.

Lime shall be applied at the rate of 25 pounds per 1,000 square feet.

Fertilizer shall be applied at the rate of 30 pounds per 1,000 square feet.

Seed shall be applied at the rate of 5 pounds per 1,000 square feet.

600.3 INSTALLATION

The subgrade of all areas to be loamed and seeded shall be raked and all rubbish, sticks, roots and stones larger than 2-in shall be removed. Loam shall be spread and lightly compacted to finished grade. Compact loam shall not be less than the depth specified. No loam shall be spread in water or while frozen or muddy.

After the loam is placed and before it is raked to true lines and rolled, limestone shall be spread evenly over loam surface and thoroughly incorporated with loam by heavy raking to at least one half the depth of loam.

Fertilizer shall be uniformly spread and immediately mixed with the upper 2-in of topsoil.

Immediately following this preparation the seed shall be uniformly applied and lightly raked into the surface. Lightly roll the surface and water with a fine spray. Seed shall be sown in a favorable season, as approved by the Engineer.

Keep all seeded areas watered and in good condition, reseeding if and when necessary until a good, healthy, uniform growth is established over the entire area seeded, and maintain these areas in an approved condition until final acceptance.

On slopes, the Contractor shall provide against washouts by an approved method. Any washout which occurs shall be regraded and reseeded at the Contractor's expense until a good sod is established. Methods and materials conforming to Section 645 Erosion Control, of the Standard Specifications for Road and Bridge Construction. NHDPW& Highways shall be used.

SECTION 700 - GRANITE BOUNDS

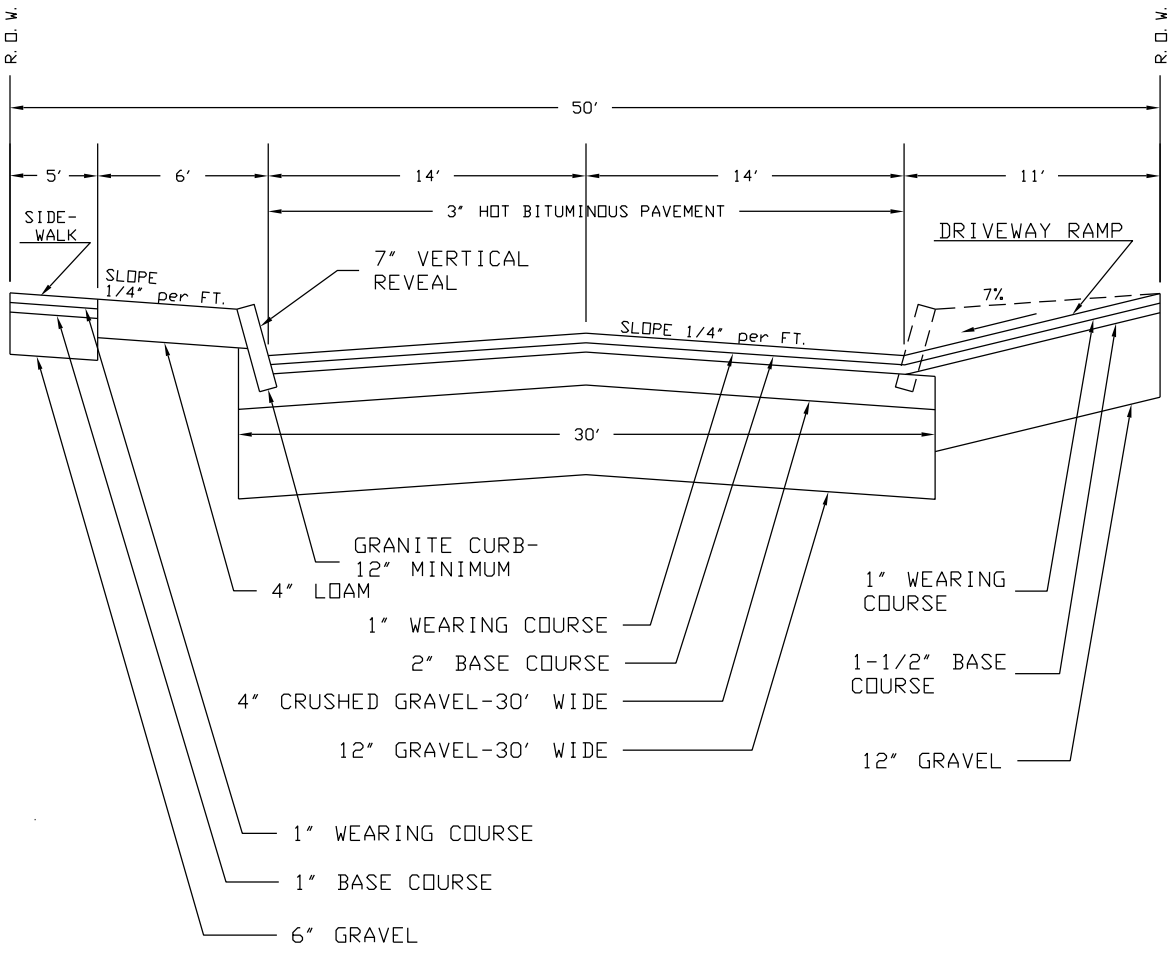
DESCRIPTION

This item consists of furnishing and setting granite stone bounds at the required locations as shown on the plan. The bounds shall be of granite and shall be free from seams which would impair their structural integrity. The minimum dimensions shall be 4" X 4" X 2'-0", and shall have a drill hole in the dressed or sawn top face.

Stone bounds shall be set at the required locations by a Land Surveyor Licensed in the State of New Hampshire.

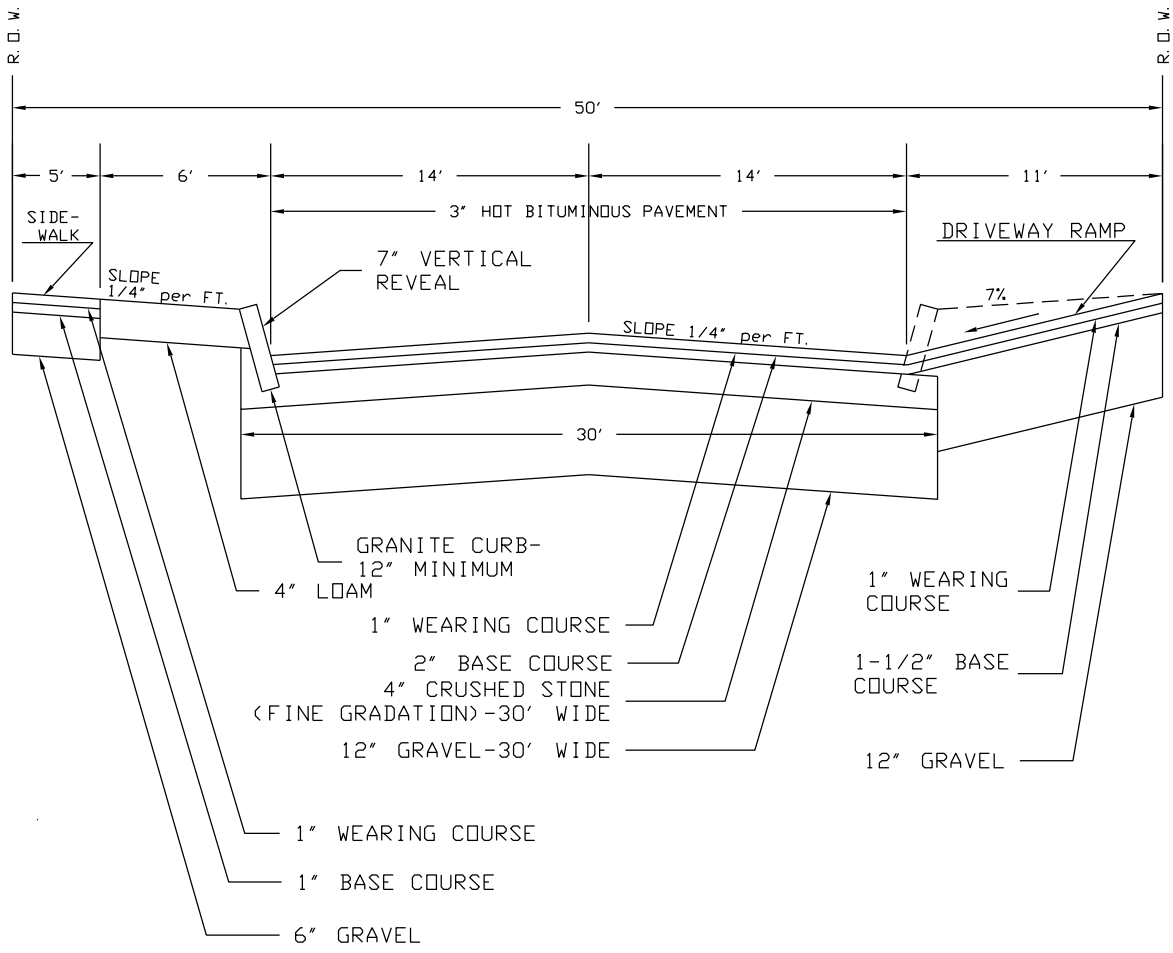
The excavation shall be made to a sufficient depth to allow the bound to protrude 4 inches above the ground. Bounds set in driveways and established lawns shall be set flush with the finished surface.

APPENDIX "A"



-TYPICAL X-SECTION-
ALT. "A"
SUBDIVISION STREET

(NOT TO SCALE)



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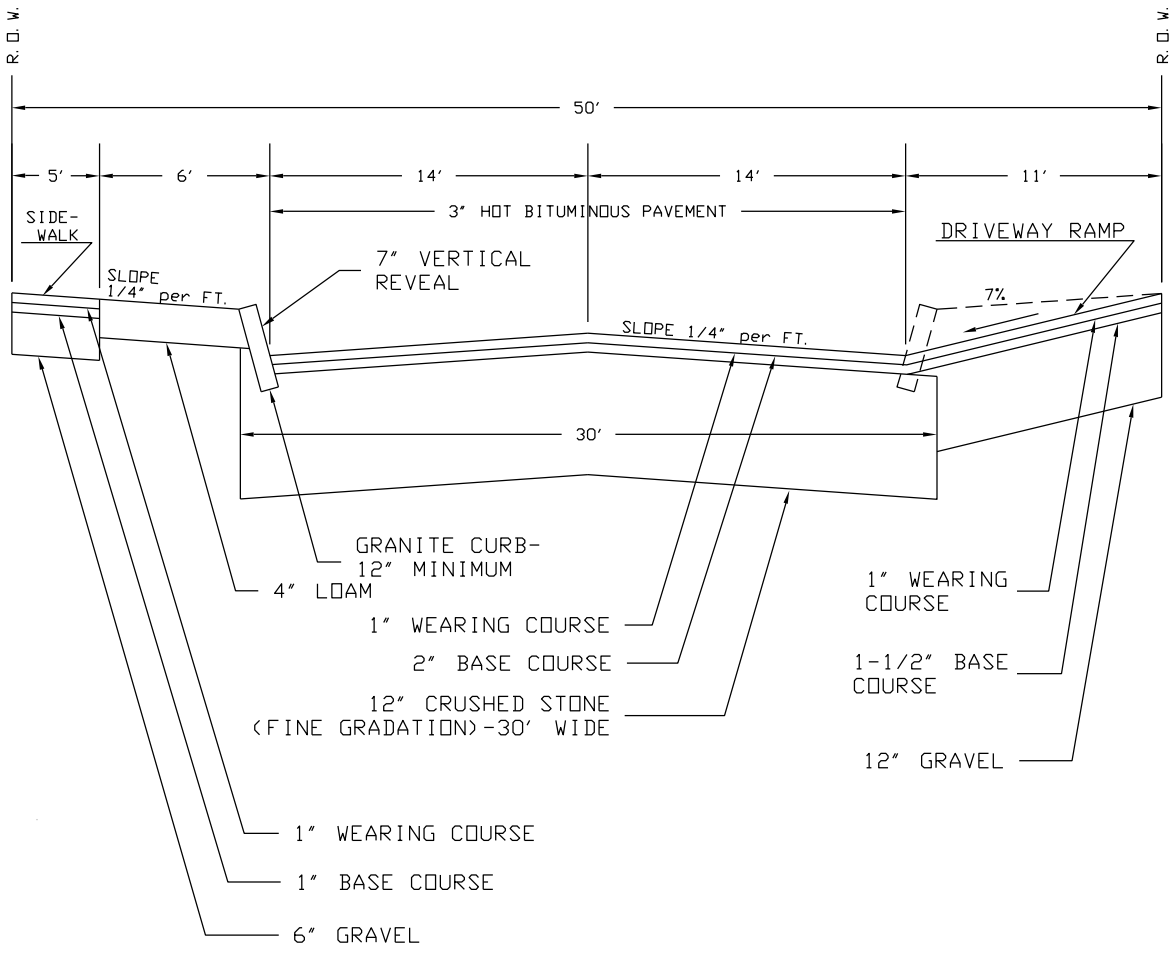
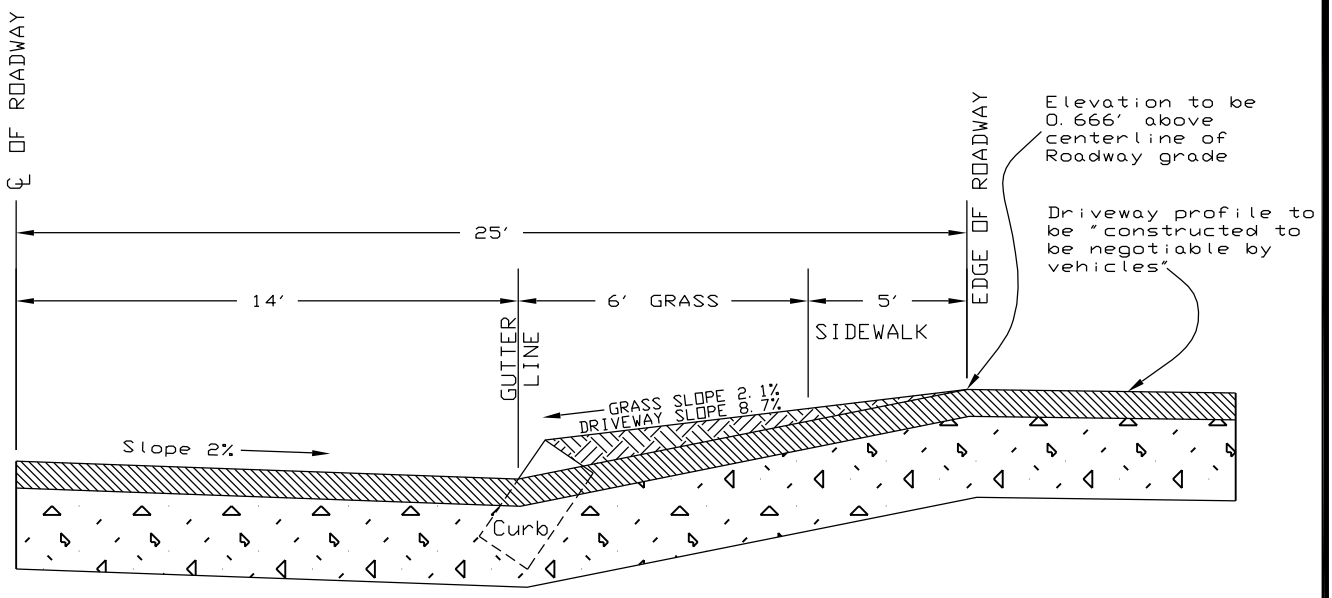
ALT. "B"
SUBDIVISION STREET

(NOT TO SCALE)



-TYPICAL X-SECTION-
ALT. "C"
SUBDIVISION STREET

(NOT TO SCALE)

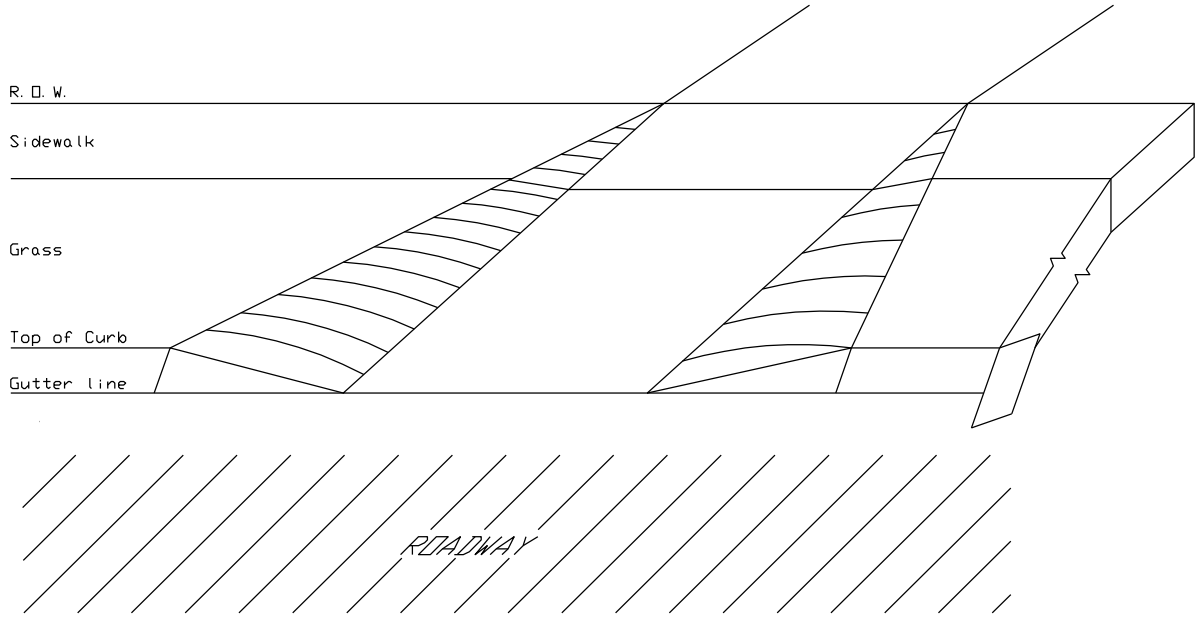


-Roadway & Driveway Cross Section-

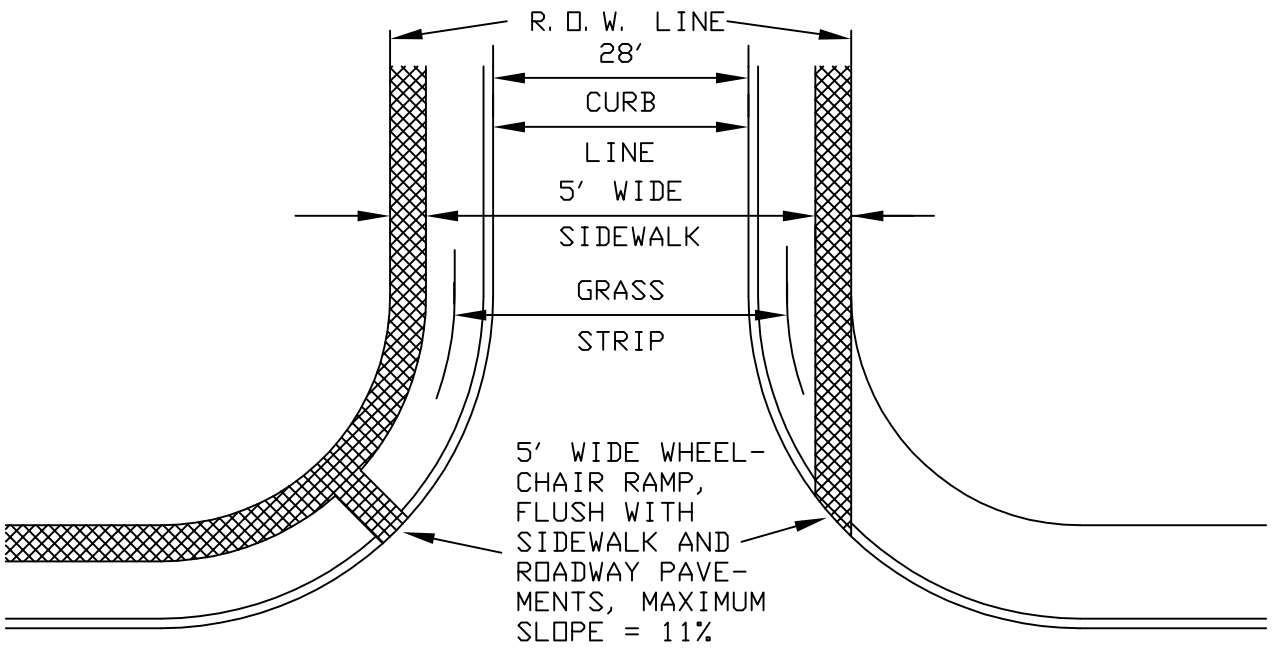
TYPICAL DRIVEWAY DETAIL

(NOT TO SCALE)

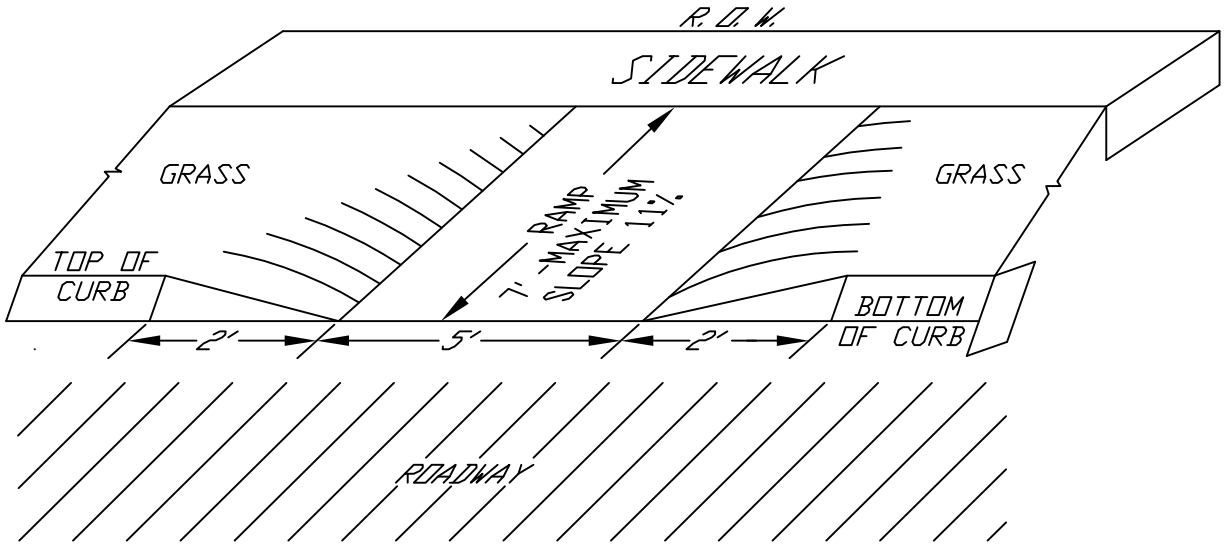
CONSTRUCT DRIVEWAY TO MEET GRADING AS SHOWN ON PERSPECTIVE.
DRIVEWAY SLOPE TO RISE 8.7% FROM E.P. TO BACK OF WALK/R.O.W.



-PERSPECTIVE-



-PLAN-



-PERSPECTIVE-

WHEELCHAIR RAMP DETAIL WITH GRASS STRIP

(NOT TO SCALE)

STANDARD SPECIFICATIONS

FOR

SIDEWALK CONSTRUCTION

NASHUA, NEW HAMPSHIRE

BOARD OF PU8LIC WORKS

APPROVED AND ADOPTED

AUGUST 28, 1995

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SECTION 100 GENERAL PROVISIONS

100.1 APPLICABILITY & AUTHORITY

1. These specifications govern all public sidewalk construction associated with new Site-Plans as well as on-site and off-site sidewalks associated with Subdivision Plans as approved by the Nashua City Planning Board; and are issued under the authority given to the City Engineer and the Board of Public Works by Section 60 of the City charter and section 16-117 of the Nashua Revised Ordinances of 1987.

   If any conflict should arise between these specifications and chapter 19, Article III, the more stringent shall govern.

2. These specifications also apply to sidewalk work which is constructed by Public Works Department employees, by virtue of its adoption as a standard by the Board of Public Works.

3. When so stated in the contract, these specifications shall govern the work of private contractors doing work under contract to the City of Nashua, Board of Public Works.

4. These specifications shall govern the work of all private contractors doing work for developers, contractors, etc. in streets and easements which shall later be dedicated for acceptance by the City of Nashua.

5. This specification supplements the Standard Specifications for Road Construction adopted June 11, 1986 and the Standard Specifications for Sewers and Drains as revised, approved and adopted on June 15, 1992, and shall not supersede these here to for adopted specifications.

6. Drainlayers, contractors and utilities desiring to work within the R.O.W. of City Streets must first obtain a Street Opening Permit from the City of Nashua Street Department on Riverside Street.

100.2 DEFINITIONS

"Contract Drawings" shall be the construction drawings which have been approved by the City Engineer, signed "approved" and on file in his office.

"Contractor" shall be the party doing the construction: either a private contractor or the Department of Public Works crews, as the case may be.

"Engineer" shall be understood to be the City Engineer, or his appointed representatives.

"Inspector" shall be understood to be an inspector of the City Engineer or his appointed representative.

"Roadway" shall mean the entire R.O.W., and any cut or fill slopes which extend beyond the R.O.W.

"Sidewalk" - That portion of the roadway primarily constructed for the use of pedestrians.

"Standard Specifications for Road and Bridge Construction, Department of Transportation" shall be the most recent available, including all revisions and addendum's.

"Subgrade" shall mean the top surface of the roadbed upon which select materials are placed.

100.3 QUALITY CONTROL

AUTHORITY AND DUTIES OF INSPECTORS

Inspectors shall be authorized to inspect all work done and materials furnished. Such inspection may extend to all or any part of the work, and to the preparation or manufacture of the materials to be used. In case of any dispute arising between the Contractor and the Inspector as to materials furnished or the manner of performing the work, the Inspector shall have the authority to reject material or suspend the work until the question be referred to and decided by the Engineer. The Inspector shall not be authorized to revoke, alter, enlarge, relax or release any requirements of these specifications nor to approve or accept any portion of the work, nor to issue instructions contrary to the plans and specifications.

The Inspector shall in no case act as a foreman or perform other duties for the Contractor or interfere with the management of the work by the Contractor. Any advice which the Inspector may give the Contractor shall in no circumstances be construed as binding to the Engineer in any way.

INSPECTION OF THE WORK

The Contractor shall not start any sidewalk, curb or road construction or lay or bury any pipes or casings or other appurtenances except in the presence of the Engineer or the Inspector. To this end, 48 hours notice shall be given the Engineer by the Contractor of the time and place he intends to do the work. Any work which is done without having given notice or is done contrary to the direction of the Engineer is considered unauthorized and will not be accepted. The Contractor shall remove and replace any unsatisfactory work.

100.4 SPECIAL CONTROLS

Erosion Control The Contractor shall take due precautions to minimize the run-off of pollution substances such as silt, clay, fuels, oils, bitumens, calcium chloride and any

other polluting materials harmful to humans, fish or other life into the waters of the State. Methods and materials conforming to section 645-Erosion Control, of the Standard Specifications for Road and Bridge Construction, State of New Hampshire Department of Transportation shall be used.

Dust Control

Dust control shall be provided when deemed necessary by the Engineer so as to prevent damage and nuisance to adjacent property owners and public streets. The means of dust control may include the use of water, calcium chloride or other approved methods.

Traffic Control The contractor shall erect and maintain traffic control devices and employ flagmen or City of Nashua Police officers to direct traffic when directed to do so by the City of Nashua Traffic Engineer. The Manual on Uniform Traffic Control devices for Streets and Highways Part IV is a part of these specifications.

Detours will only be allowed after obtaining a "Permit to Encumber" from the City Traffic Engineer.

A request for the "Permit to Encumber" shall be accompanied with a detailed plan containing the following:

l. Street to be closed

2. Location of construction signs

3. Location of flagmen

4. Dates and hours of the proposed detour

5. Method for notifying the public agencies affected

6. Method for notifying the general public

7. Method for notifying the effected abutters

8. Telephone Numbers of Responsible Persons available in emergency-24 hours/day 7 days/week.

When, in the opinion of the City Traffic Engineer, public safety or convenience requires the services of the police, the City Traffic Engineer may direct the Contractor to request the Nashua Police Department to assign officers to direct traffic within the location of work.
Nothing contained herein shall be construed as relieving the Contractor of any of his responsibilities for protection of persons and property.

Police are to be paid by the Contractor.

Use of Explosives

The storage, handling, transportation and use of explosives shall conform with all Federal, State, and local laws and regulations, including the rules and regulations of the Director of State Police, The City of Nashua Fire Rescue, and the provisions below.

The Contractor's attention is called to RSA I 58:9-a (SUPP.), which in part provides that licenses must be obtained from the Director of State Police in order (1) to use, purchase, or transport explosives, or (2) to store explosives.

When the use of explosives is necessary for the prosecution of the work, the Contractor shall exercise the utmost care not to endanger life or property, including new work. The Contractor will be responsible for all damage resulting from the use of explosives.

All explosives shall be stored in a secure manner. All storage places shall be clearly marked. Explosives shall be stored in a magazine which shall be located in respect to buildings, railways, and highways in a manner as required by the Director of State Police and the Chief of Nashua Fire Rescue.

The Contractor shall notify each public utility company having structures in proximity to the site of the work of his intention to use explosives. Such notice shall be given sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property from injury.

Explosives shall be used only during daylight hours, shall be handled only by competent workmen, and particular care shall be taken to insure that no unexploded charges remain in the work

All persons within the danger zone of blasting operations shall be warned and no blasting shall be done until the zone has been cleared. Sufficient flagmen shall be stationed outside the danger zone to stop all approaching traffic during blasting operations.

100.5 SUITABILITY OF MATERTALS

All materials to be used shall be subject to inspection and approval or rejection by the Engineer. Any material rejected shall be immediately removed from the work site.

100.6 SAMPLING AND TESTTNG OF MATERIALS

The cost of sampling and testing will be the responsibility of the contractor doing the work. In the case of a Licensed Drainlayer, the cost of sampling and testing will be billed through the "Inspectors Fees Procedure". The contractor may elect to have materials sampled and tested by an independent testing laboratory of his choice, provided the laboratory meets with the approval of the Engineer; in which case, sampling shall be done

in the presence of an Inspector and test results furnished to the Engineer. Sampling and testing frequency will be determined by the Engineer. Previously approved material, later found to be unacceptable shall be considered as having never been approved, and shall be removed from the work site.

100.7 MATERIALS FOR WHICH NO SPECIFICATION HAS BEEN ADOPTED BY THE BOARD OF PUBLIC WORKS

In the event a material to be used is not specifically mentioned in these specifications, the acceptance and use of such material shall be subject to prior approval by the Engineer. The contractor or developer shall submit his request with documentation, test results, and samples to the Engineer.

SECTION 200 - EARTHWORK

200.1 CLEARING AND GRUBBING

SC0PE OF WORK

Clearing and grubbing shall be carried out where necessary. The Contractor will be allowed to remove only the trees and brush that are absolutely necessary for his construction operations. The Contractor shall be expected to save as many trees as is possible. The removal of all brush and trees, including their stumps necessary for construction purposes, shall be done in such a manner to present a neat appearance at the end of the work. No stumps, roots, brush or timber shall be buried within the limits of the roadway, or within the limits of any lot to be dedicated for public purposes, or within the limits of any public easement.

CLEARING

Clearing shall consist of felling, cutting and the satisfactory disposal of trees, brush and other vegetation, down timber, and rubbish.

If land owners desire the timber or small trees, the Contractor shall cut and neatly pile it in 4-ft. lengths for removal by the land owner; otherwise the Contractor shall dispose of it by hauling away. No burning will be permitted unless the Contractor obtains the permission of the City of Nashua Fire Chief beforehand.

GRUBBING

Grubbing shall be carried out where trees have been felled, and shall consist of the removal and disposal of stumps, including all roots larger than 3-in. in diameter to a depth of 18-in. below ground surface and within a 3 ft. radius of the trunk. Stumps within the limits of the sidewalk shall be completely removed.

200.2 EXCAVATION F0R SIDEWALKS

Earth excavation shall be considered all excavation not included as rock excavation. The removal of bituminous pavements shall be considered as earth excavation.

Rock Excavation shall consist of all solid rock which requires for its removal drilling and blasting. It shall also consist of boulders and parts of masonry structures when found to measure 2 cubic yards or more. The removal of concrete pavements shall be considered as rock excavation.

Where excavation to designed elevations results in a subgrade or slope of unsuitable material, the contractor will be required to remove the unsuitable material as directed by Engineer. the backfilling will be done with approved materials and compacted to the design subgrade or slope.
Over-excavated subgrade in rock shall be backfilled to design subgrade with porous material, such as sand, gravel, or broken rock. Non-porous materials will not be acceptable.

200.3 WINTER CONSTRUCTION METHODS

No sidewalk shall be constructed on frozen earth materials. Each layer of material placed shall be compacted to the required density before it freezes. All frozen material shall be removed from the sidewalk prior to placing additional material.

200.4 DENSITY REQUIREMENTS AND TESTS

Earth materials used to construct sidewalks shall be compacted to at least 95 percent of maximum density. The maximum density determination will be made as specified in AASHTO T99 (Standard Proctor Test). The in place density determination will be made by AASHTO Tl91 (Sand cone method), AASHTO T204 (Drive Cylinder Method), or by AASHTO T238 and T239 (Nuclear Method). The contractor shall obtain whatever equipment is necessary to achieve the specified density.

SECTION 300 - CONCRETE SIDEWALKS

300.1 DESCRIPTION OF WORKS

This section consists of furnishing, placing, finishing, curing, stripping, coating and clean up work in the installation of Portland cement concrete sidewalks. The sidewalks shall be 4" thick and shall have a maximum cross-slope of 2% (1/4" per foot), reinforced as specified in Section 300.3 and installed on a properly graded, compacted 6" gravel subgrade having a minimum width of 5 ft. or as shown on the construction plans or as directed by the engineer.

Where appropriate, item numbers correspond to New Hampshire Department of Transportation standard specifications for road and bridge construction. All the requirements of Section 608 sidewalks, of the New Hampshire Department of Transportation standard for road and bridge construction staff apply, unless more stringent requirements are stated herein.

300.2 MATERIALS

Portland Cement Concrete shall be Class AA and shall conform to section 520-Portland Cement Concrete of the NH DOT Standard Specifications for Road & Bridge Construction.

Portland cement concrete sidewalks shall be Class AA having a minimum compressive strength of 4000 lbs. after 28 days and shall conform to the following mix formula:

Class	Minimum 28 day compliance strength	Min. Amount of cement per C Y. of concrete		Max. Gallons of Water per bag of cement	Max. Water/ Cement Ratio	% Estimated Air
Concrete	P.S.I.	Lbs.	Bags	Gallons		
AA	4000	658	7.0	5.00	0.444	5-8

300.2.2 PORTLAND CEMENT

Portland cement shall be Type II or Type IP conforming to AASHTO M 85 or M 240, and shall be the same type and color throughout the entire continuous sidewalks work being done. In repairing or replacing individual sections of sidewalks every effort shall be made to match the color of the adjacent concrete sidewalks.

300.2.3 AGGREGATE

Coarse aggregate shall consist of crushed stone, gravel, or other approved inert materials with similar characteristics or combinations thereof having hard, strong, durable particles, free from surface coating and injurious amounts of soft, friable, or laminated pieces, and free of alkaline, organic, or other harmful matter. Material passing the No. 200 sieve as determined by AASHTO T 11 shall not exceed 1.0 percent by weight. Thin or elongated particles shall not exceed 1.0 percent by weight. Thin or elongated particles shall not exceed 10 percent by number as determined by Corps of Engineers specifications CRD-C119, on a 3 to I ratio and a minimum of 100 particles The percent of wear shall not

exceed 40 as determined by AASHTO T 96 and the material shall conform to the following gradation.

Required grading: Coarse Aggregate

Class of Concrete	AA
Standard stone-size	67
Nominal Size	3/4" to No 4

Sieve Size	Percentage by Weight Passing
2 inch	
1-1/2 inch	
I inch	100
3/4 inch	90 –100
1/2 inch	
3/8 inch	20- 55
No.4	0-10
No.8	0-5

Fine aggregate shall consist of sand, stone screenings, or other materials with similar characteristics, or a combination thereof Tests for organic impurities shall be in accordance thereof Tests for organic impurities shall be in accordance with AASHTO T 21 and T 71. Fine aggregate showing a variation in fineness modulus greater than 0.2 above or below that upon which mix was designed may be rejected.

The graduation of fine aggregate from any source shall be reasonably uniform and the fineness modulus as determined by AASHTO M 6 shall lie between 2.5 and 3.1, and shall conform to the following graduation.

Required grading: Fine Aggregate

Sieve Size	Percentage by Weight Passing
3/8 inch	100
No. 4	95-100
No. 16	45 - 80
No. 50	10 - 30
No. 100	2-100
No.200	0-3

300.2.4 PROTECTIVE COATING

Sidewalk protective coating consists of a boiled linseed oil mixture conforming to AASHTOM 230 and shall be composed of 50 percent double boiled linseed oil and 50 percent petroleum spirits by volume or approved equal.

300.2.5 STEEL MESH

Steel mesh shall be in accordance with the Concrete Reinforcing Steel Institute with a minimum spacing of 6 x 6 - W 2.9 x W 2.9.

300.2.6 EXPANSION JOINTS

Expansion joint filler shall conform to AASHTO M 153, Type III or AASHTO M 213.

300.3 C0NSTRUCTION REQUIREMENTS

When the average daily temperature falls below 35 degrees Fahrenheit for more than one day, concrete sidewalks shall not be poured without protective measures to prevent damage to the concrete by freezing. The contractor shall submit his proposed protective methods to the City Engineer's Office for approval. Concrete shall be protected from freezing for a minimum of 5 days.

Excavation shall be made to the required depth and to a width that will permit the installation and bracing of the forms. The foundation shall be shaped and compacted to a firm, even surface conforming to the section shown on the plans, all soft and yielding material shall be removed and replaced with acceptable material.

Granular backfill of the specified or ordered gradation shall be placed in layers at the locations shown or as ordered. Backfill shall be placed in the manner detailed m the section in connection with which the backfill is specified. The backfill layers shall not exceed 6 inches of computed depth unless otherwise directed.

Forms shall be of wood or metal and shall extend for the full depth of the concrete. All forms shall be straight, free from warp, and of sufficient strength to resist the pressure of the concrete without springing. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.

The foundation shall be thoroughly moistened immediately prior to the placing of the concrete. The proportioning, mixing, and placing of the concrete shall be in accordance with section 520.3. Portland Cement Concrete-Construction Requirements of the NH DOT Standard Specification for Road and Bridge Construction.

Steel Mesh reinforcement shall be used across the full width of commercial and industrial use driveways and shall be placed at mid-depth or as shown on the plans. The sidewalk shall be divided into 5-foot sections by dummy joints formed by a jointing tool or other acceptable means as directed. These dummy joints shall extend into the concrete for at least 1/3 of the depth and shall be approximately 1/8 inch wide.

Expansion joints shall be formed around all appurtenances such as manholes and utility poles for the full depth of the sidewalk. Expansion joint filler 1/2 inch in thickness shall

be installed between concrete sidewalks and any fixed structure such as building or bridge. This expansion joint material shall extend for the full width and depth of the walk.

Finishing

Concrete shall be finished by use of wood, or magnesium floats, by skilled concrete finishers.

Joints

All outside edges and joints shall be edged with an edging tool having a radius of 1/4 inch. No plastering of the surface will be permitted. After floating, edging and jointing, the surface shall be brushed by drawing fine-grained broom over the surface to produce a non-slip surface.

Curing

Concrete shall be cured for a minimum of 7 days. Curing compounds will not be permitted. Plastic sheets or other approved materials shall be placed in close contact with the finished concrete as soon as the concrete has set sufficiently to avoid damage from the placement of coverings. The protective covering shall be maintained vapor-proof in close contact with the concrete for the entire 7-day period. All traffic shall be excluded during the curing period. During curing, all traffic, both pedestrian and vehicular shall be excluded.

Water repellent with linseed oil may be applied on horizontal surfaces by any approved means. If a sprayer is used, the nozzle shall be held within 18 inches of the concrete or as directed.

Two coats of linseed oil mixture shall be applied. The first shall be at a rate sufficient to obtain maximum penetration, taking care to prevent the material from discoloring curbs or other parts of the work. The second coat shall be applied as a seal coat, with attention given to o the lighter appearing areas. The rate of application shall be approximately 0.025 gallons per square yard for the first coat, or an average of approximately 25 square yards per gallon. The second application shall not be made until the concrete has regained its dry appearance and in any event not until at least 24 hours have passed.

The edges of the sidewalk shall be backfilled as necessary with suitable material compacted and finished flush with the top of the sidewalk.

Handicap ramps shall be constructed at street intersections as per section 700 which are part of these specifications.

SECTION 400 - HOT BITUMINOUS SIDEWALK

400.1 Description of Work

This work shall consist of constructed hot bituminous pavement sidewalks on a properly graded and compacted sub-grade. The sidewalk shall be constructed in (2) - 1" courses having a minimum width of 5 feet or as shown on the construction plans or as directed by the engineer.

Where appropriate, item numbers correspond to NH DOT Standard Specification for Road and Bridge Construction. All the requirements of Section 608 Sidewalks of the NH DOT Standard Specification for Road and Bridge Construction shall apply, unless more stringent requirements are stated herein.

400.2 MATERIALS

Hot Bituminous Pavement

Hot Bituminous Pavement shall meet the material requirements of section 401- Plant Mix Pavements of the NH DOT Standard Specification for Road and Bridge Construction, except that the composition of mixtures shall conform to the following mix formula:

Course	**Binder**	**Wearing**
Sieve Size	**Percentage by Weight Passing**	
1/2 inch	95-100	
3/8 inch	90-100	98-100
No.4	45-75	80-100
No. 10	30-50	40-65
No. 20	17-37	25-45
No. 40	10-30	18-33
No. 80	5-20	8-20
No. 200	2-6	2-6
Asphalt Cement Percent of Mixture	5.5-7.5	6-9

.

400.3 CONSTRUCTION REQUIREMENTS

The plant, mixing methods and hauling shall conform to the provisions of section 401 Plant Mix pavements - Cereal of the NH DOT Standard Specification for Road and Bridge Construction.

The sidewalks shall be constructed having a compacted binder coarse (1) inch in thickness and a compacted wearing coarse (1) inch in thickness.

Handicap ramps shall be constructed at street intersections section 700 as per appendix "A" which are part of these specifications.
Any Bituminous Pavement delivered to the project having a temperature lower than 250 degrees Fahrenheit shall not be used. The pavement shall be thoroughly compacted in accordance with 400.13 before the mix cools to 180 degrees Fahrenheit.

The Engineer shall have the authority to prevent the starting of a paving operation or to suspend a paving operation that has begun, when in his opinion a satisfactory final product cannot be produced.

Mixtures shall be placed only when the underlying surface is dry, frost-free and the surface temperature and air temperature is above 40 degrees Fahrenheit. No load shall be sent out so late in the day that spreading and compacting cannot be completed during daylight. Wearing course shall not be placed after October 30th, unless specifically permitted in writing by the Engineer. Base course pavement shall not be placed until the Engineer has been given the he opportunity to inspect the crushed gravel for conformance to the plans and specifications. Wearing course pavement shall not be placed until the Engineer has been given the opportunity to inspect the base course pavement for conformance to the plans and specifications.

Any base course pavement which has been exposed for a considerable length of time, such as over the winter, or has a dusty surface, shall be uniformity covered by a tack coat of emulsified asphalt immediately prior to paving the next course.

Emulsified asphalt for tack coat shall be SS-1, SS-lh, CSS-1, or CSS-lh diluted one part water to one part emulsified asphalt. The tack coat shall be applied on only as much pavement as can be covered with asphalt-aggregate mixture in the same day. The rate of application shall be 0.05 to 0.15 gals/s.y., as directed by the Engineer.

A tack coat of emulsified asphalt shall be applied to the contact edge of all utility castings, the contact edge of existing pavement, and to the contact edge of any previously placed mat that, in the opinion of the Engineer, will result in a cold joint. A longitudinal or transverse joint left open overnight shall be considered a cold joint, and will require a tack coat prior to continuing with the paving operation.

The bituminous pavement shall be spread uniformly in two courses as specified above. Each course shall be rolled with a roller weighing between 500 pounds and 2000 pounds. The finished surface shall be uniform in appearance, free from irregularities, and shall present a smooth surface. The edges shall be trimmed as directed.

The edges of the sidewalk shall immediately be backfilled as necessary with suitable material compacted and finished flush with the top of the sidewalk.

All loads of hot bituminous pavement shall be accompanied with a delivery slip, one copy to be retained by the engineer for his records. The slip shall have the following information:

a) Source of material
b) Type of material
c) Tons of material
d) Date
e) Plant inspectors initials (when appropriate)

SECTION 500 - GRANITE CURBING

500.1 DESCRIPTION OF WORK

This item consists of furnishing and installing slope, vertical, and radius granite curbing, which shall be used for highways, residential streets, parking areas, driveways and traffic islands.

500.2 SLOPE GRANITE CURBING

500.2.1 MATERIALS

Curbing shall be of hard and durable granite, light gray in color, and free from seams which impair its structural integrity. Variations characteristic of the formation are permitted.

Dimensions shall conform to the following:

Top - wire sawed to approximate true plane and shall be three (3) to nine (9) inches wide.

Front or exposed face - shall be smooth quarry split to an approximate true plane. Dimension of face shall be twelve (12) inches plus or minus one (1) inch. Face shall have no projections or depressions greater than one (1) inch, under a two-foot straight edge.

Back or Concealed Face - shall be approximately parallel to the front or exposed face.

Length of Stone - minimum length shall be two (2) feet.

Ends of Stone - shall be square with the plane of the face and so finished that, when the stones are flat, no space more than one inch shall show in the joint for the full width of the face. Slope granite curb, when used on a radius of twenty (20) feet or less, shall be cut with radial joints.

500.2.2 CONSTRUCTION REQUIREMENTS

Curb shall be set at line and grade required by the City Engineer on an approved foundation on a one to one (1:1) slope, and shall project seven (7) inches above the shoulder grade or pavement, unless otherwise directed.

Slope granite curb, when used on a radius of twenty (20) feet or less, shall be cut with radial joints.

Joints between curbstones shall be carefully filled with mortar for a depth of three (3) inches from the face. They shall be neatly joined on the face, and all excess mortar shall be satisfactorily cleaned from the curbstone face

Cement mortar shall be compared of equal parts of cement and sand with sufficient water to form workable moisture.

Curbing shall be placed in a minimum of six (6) inches of compacted gravel. Curbing shall be set as specified and all spaces under curbstones carefully and thoroughly rammed so that the curbstone shall be completely supported throughout their entire length.

500.3 VERTICAL GRANITE CURBING

500.3.1 MATERIALS

Curbing shall be of hard and durable granite, light gray in color, and free from seams which impair its structural integrity. Variations characteristic of the formation are permitted.

Dimensions shall conform to the following:

Granite curb both straight and radius, shall conform to the following:

Top - wire sawed to an approximate true plane and shall be five (5) inches plus or minus one-eighth (1/8) inch wide.

Front or exposed face - shall be at right angles to the plane of the top and shall be smooth quarry - split. Depth of curbing shall be eighteen (18) inches plus or minus (1) inch. Front face shall have no depressions or projections greater than one half (1/2) inch measured from the vertical plane of the face from a distance down from the top of ten (10) inches.

Back or Concealed Face - shall be parallel with the front or exposed face and shall have no projections for a distance of (3) inches down from the top.

Bottom - shall be approximately parallel to the top and shall have a minimum width of (4) inches.

Length of Stone - minimum length shall be 3-0 feet.

Ends of Stone - shall be square with the planes of the top and front face and so finished that, when curbing is set' no space more than three - quarters (3/4) inch shall show in the joint for the full width of the top or down on the face for eight (8) inches. Remainder of end may break back not over four (4) inches from the plane of the joint.

500.3.2 CONSTRUCTION REQUIREMENTS

Curb shall be set at line and grade required by the City Engineer and shall project seven (7) inches above the shoulder grade or pavement, unless otherwise directed.

Joints between curbstones shall be carefully filled with cement mortar and shall be neatly pointed on top and exposed front portions.

Cement mortar shall be composed of equal parts of cement and sand with sufficient water to form a workable mixture.

Curbing shall be placed in a minim urn of six (6) inches of compacted gravel. Curbing shall be set as specified and all spaces under curbstones carefully and thoroughly rammed so that the curbstone shall be completely supported throughout their entire length.

SECTION 600 – LOAMING AND SEEDING

600.1 MATERIALS

Loam shall be fertile, natural soil, typical or the locality, free from large stones, roots, sticks, clay, peat, weeds and sod and obtained from naturally well drained area. It shall not be excessively acid or alkaline nor contain toxic material harmful to plant growth.

Fertilizer shall be a complete commercial fertilizer, 10-10-10 grade. It shall be delivered to the site in the original; unopened containers each showing the manufacturer's guaranteed analysis. Store fertilizer so that when used it shall be dry and free flowing.

Lime shall be ground limestone containing not less than 85 percent calcium and

magnesium carbonates.

Seed shall be from the same or previous year's crop; each variety of seed shall have a

percentage of germination not less than 90, a percentage of purity of not less than 85, and shall have not more than one percent weed content. The mixture shall consist of seed proportioned by weight as follows:

For grassplots and lawns: -

Canadian Creeping Red Rescue	50%
Kentucky Bluegrass	20%
Red Top	15%
Domestic Rye Grass	15%

Seed shall be delivered in sealed containers bearing the dealer's guaranteed analysis.

600.2 APPLICATI0N

Loam shall be placed to a minimum depth of 4 inches.

Lime shall be applied at the rate of 25 pounds per 1,000 per square feet.

Fertilizer shall be applied at the rate of 30 pounds per 1,000 square feet.

Seed shall be applied at the rate of 5 pounds per 1,000 square feet.

600.3 INSTALLATION

The subgrade of all areas to be loamed and seeded shall be raked and all rubbish, sticks, roots and stones larger than 2-in. shall be removed. Loam shall be spread and lightly compacted to finished grade. Compact loam shall *not* be less than the depth specified. No loam shall be spread in water or while frozen or muddy.

After the loam is placed and before it is raked to true lines and rolled, limestone shall b spread evenly over loam surface and thoroughly incorporated with loam by heavy raking to at least one half the depth of loam.

Fertilizer shall be uniformly spread and immediately mixed with the upper 2-in. of topsoil.

Immediately following this preparation the seed shall be uniformly applied and lightly raked into the surface. Lightly roll the surface and water with a fine spray. Seed shall be sown in a favorable season, as approved the Engineer.

Keep all seeded area watered and in good condition, reseeding if and when necessary until a good, healthy, uniform growth is established over the entire area seeded, and maintain these areas in an approved condition until final acceptance.

On slopes, the Contractor shall provide against washouts by an approved method. Any washout which occurs shall be regraded and reseeded at the Contractor's expense until a good sod is established. Methods and materials conforming to Section-645 Erosion

Control, of the Standard Specification for Road and Bridge Construction, NH DOT shall be used.

SECTION 700 - SIDEWALK RAMPS

700.1 DESCRIPTION

Sidewalk ramps are required wherever sidewalks on streets and ways or curbing are being constructed, reconstructed or other repair improvements are being made thereon.

700.2 LOCATION

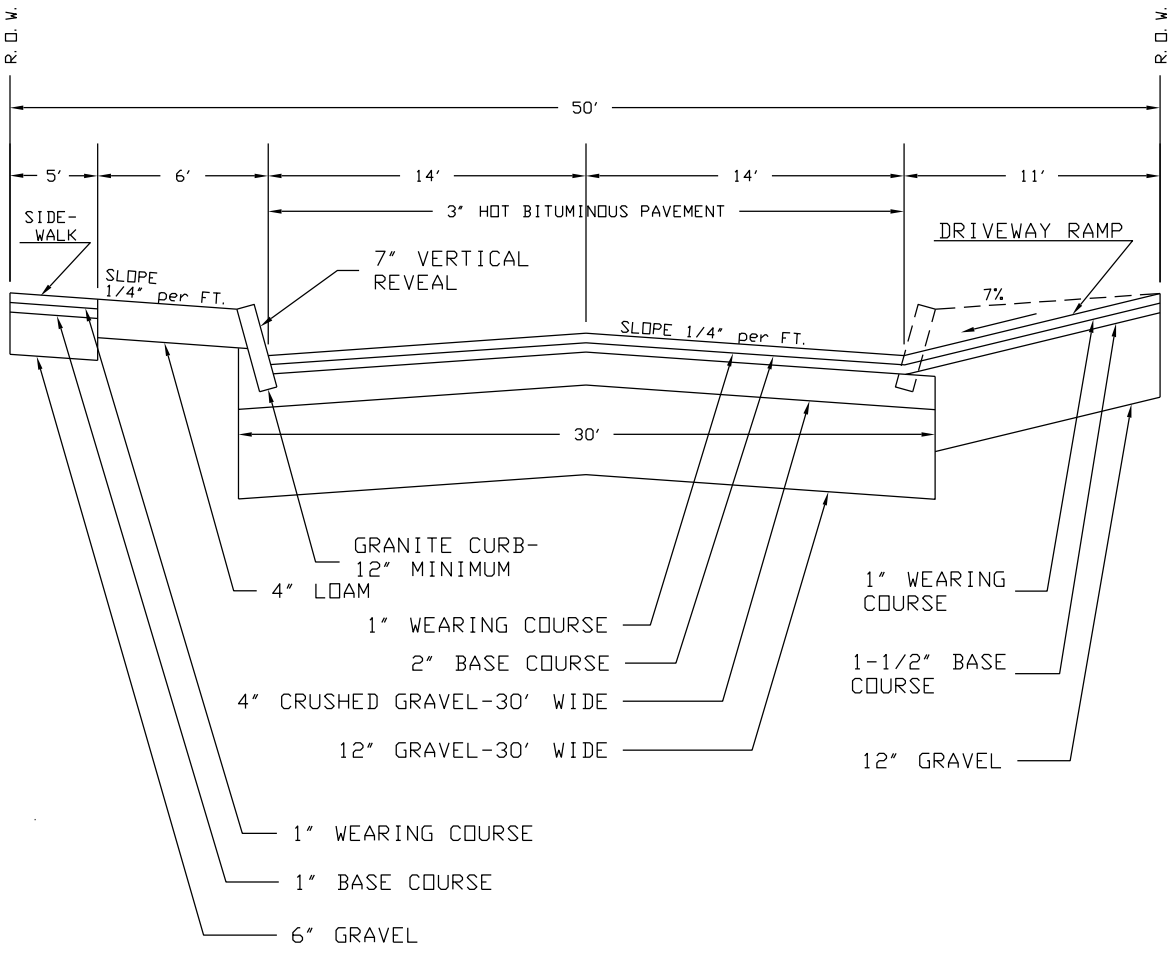
Sidewalk ramps shall be located at each corner of each intersection and also at each street crossing which is not an intersection. Sidewalk ramps at corners shall be as close as possible to the apex or the center of the radius of curb intersection with consideration for the intersection geometry and safety hazards.

700.3 CONSTRUCTION REQUIREMENTS

Width of the sidewalks shall not be less than 60", and shall have a continuous common surface, not interrupted by steps or abrupt changes m level greater than 1/2". Concrete sidewalks shall have a non-slip or broom finish.

See figures 2 and 3 which are a part of these specifications.

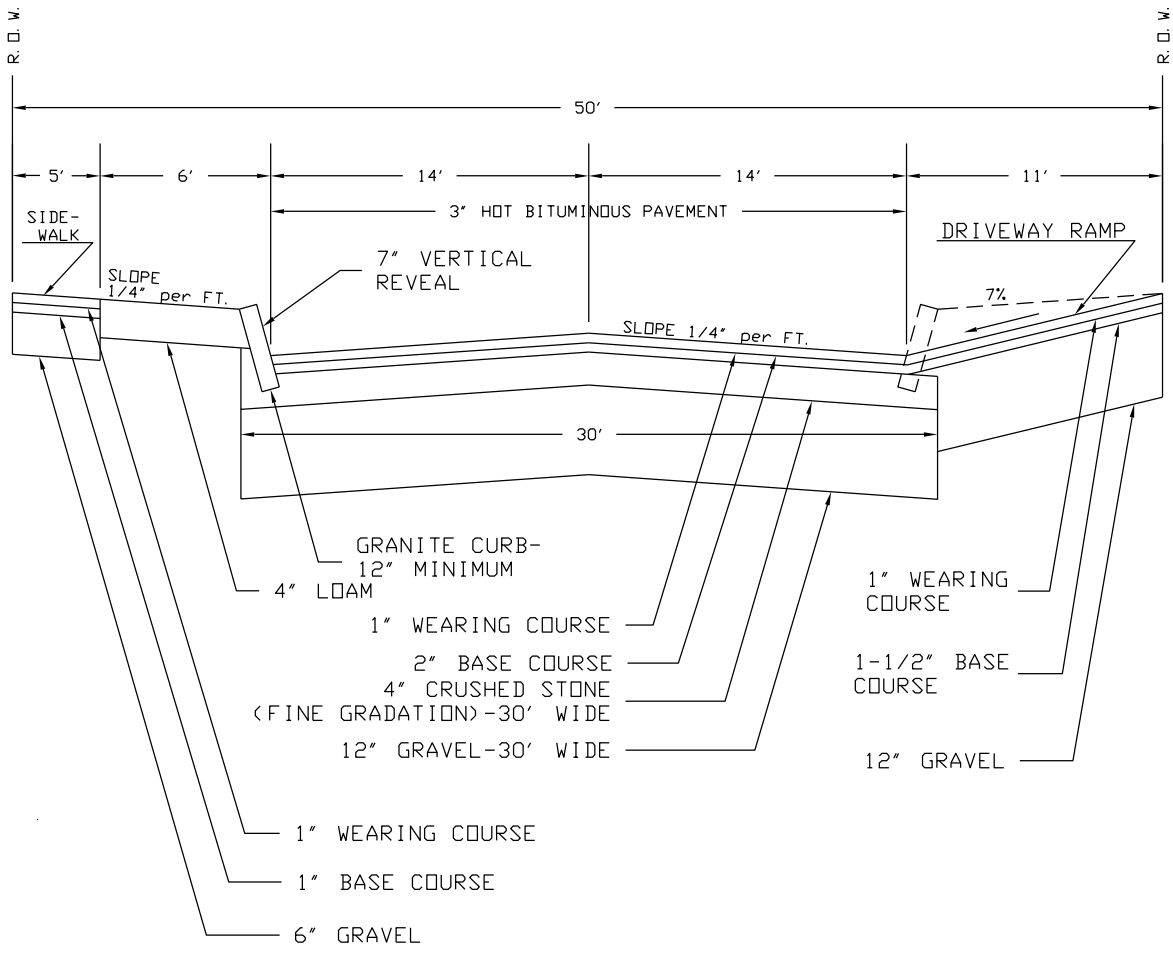
Figure 1A



-TYPICAL X-SECTION-
ALT. "A"
SUBDIVISION STREET

(NOT TO SCALE)

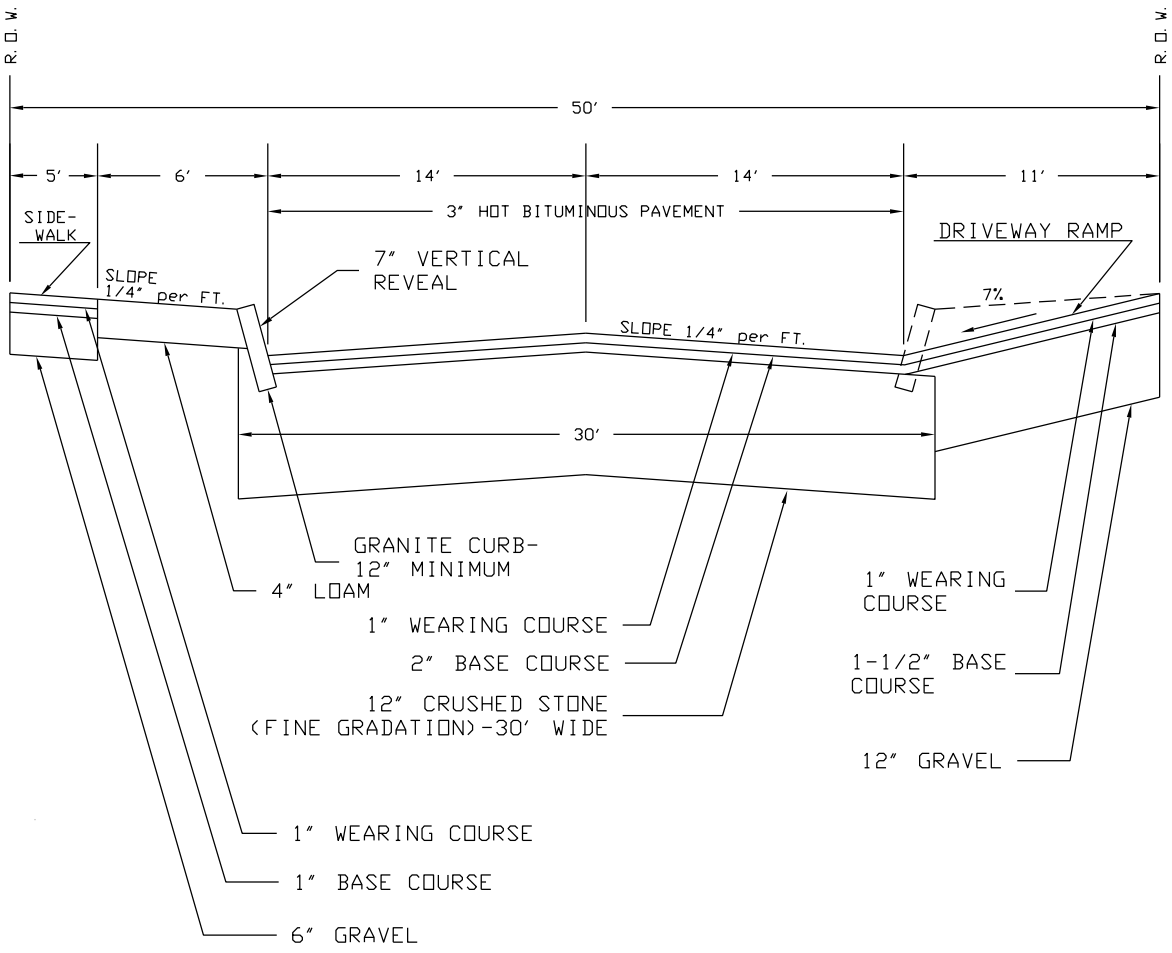
Figure 1B



-TYPICAL X-SECTION-
ALT. "B"
SUBDIVISION STREET

(NOT TO SCALE)

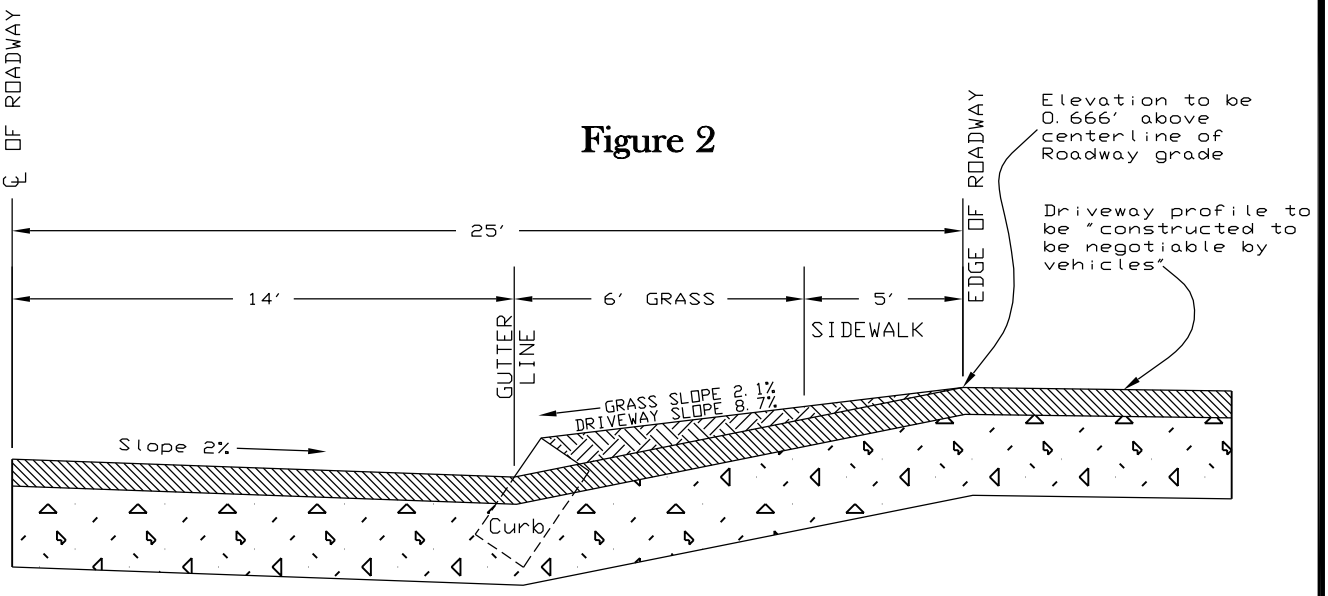
Figure 1C



-TYPICAL X-SECTION-
ALT. "C"
SUBDIVISION STREET

(NOT TO SCALE)

Figure 2

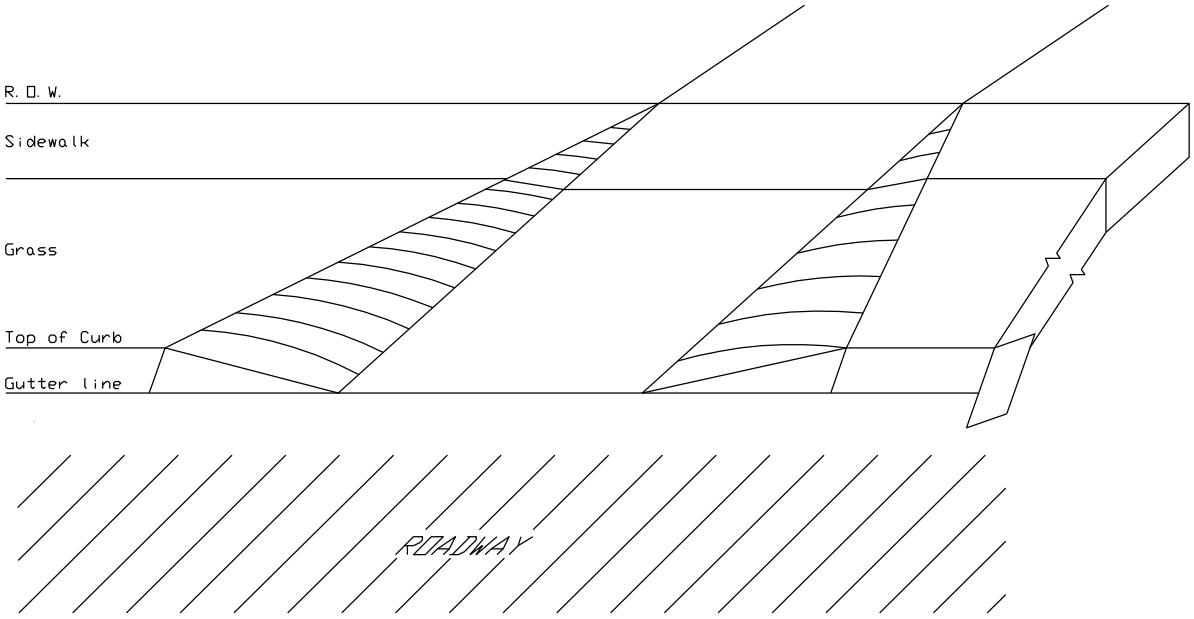


-Roadway & Driveway Cross Section-

TYPICAL DRIVEWAY DETAIL

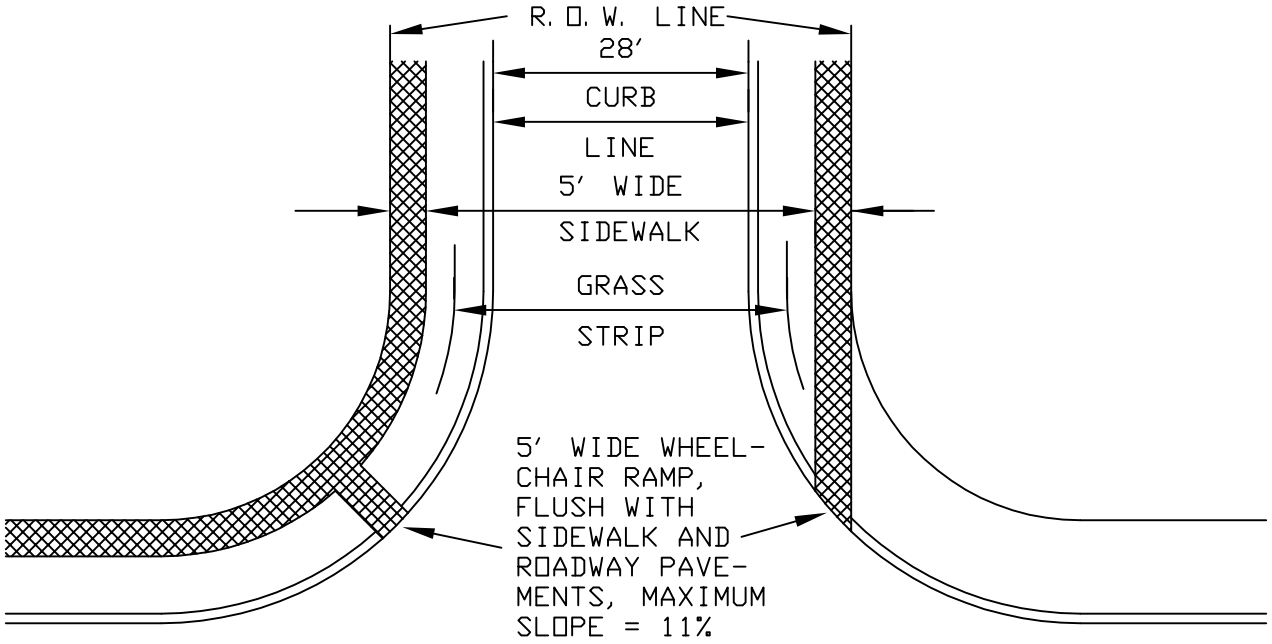
(NOT TO SCALE)

CONSTRUCT DRIVEWAY TO MEET GRADING AS SHOWN ON PERSPECTIVE.
DRIVEWAY SLOPE TO RISE 8.7% FROM E.P. TO BACK OF WALK/R.O.W.

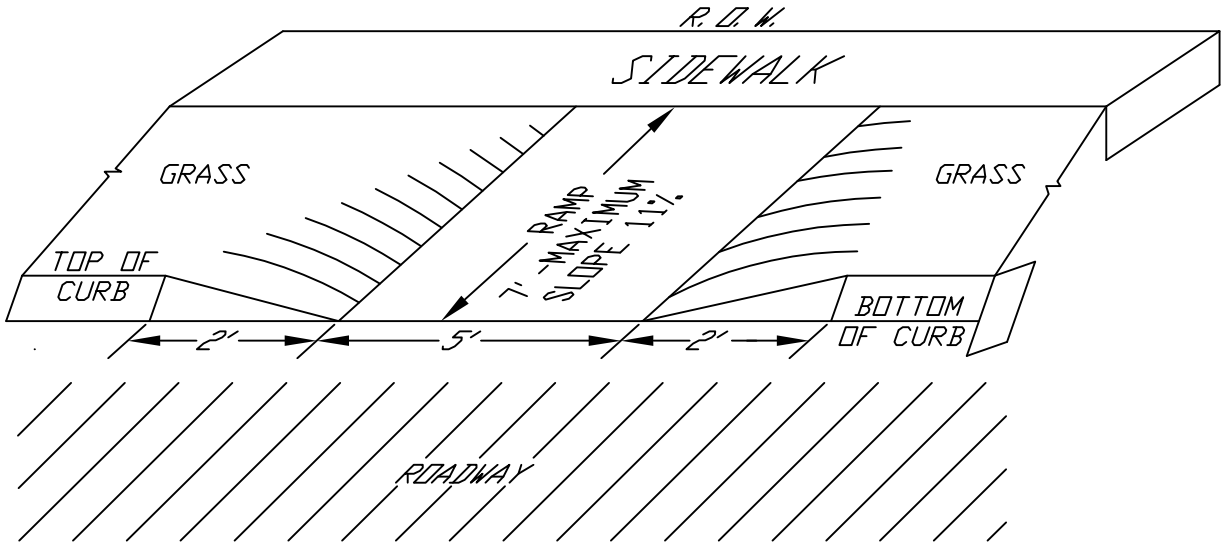


-PERSPECTIVE-

Figure 3



-PLAN-



-PERSPECTIVE-

WHEELCHAIR RAMP DETAIL
WITH GRASS STRIP

(NOT TO SCALE)